the OIL AND GAS JOURNAL

JANUARY 9, 1956

New Cars Put Heat on U.S. Refiners

The 1955 octane cushion is disappearing as compression, horsepower still climb. p. 58

What's New in Compressor Piping?

Research project is aimed at pulsation control and maximum compressor efficiency. p. 80

Twelve Steps to Better Oil-Finding

Management can close ranks of geologists and geophysicists . . . and now is the time. p. 148

Pipeliners Ask: "Who pays for new road crossings?" • p. 70

we have been asked...

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A glance ahead . . . at press time

These trends will make TOMORROW'S NEWS

Some folks think piracy of technical help will increase. Many smaller companies admit they already are depending upon it for key people. The big companies force them to it, they say, by hiring graduates by the dozen. And, the shortage of technically trained graduates is expected to get worse.

Don't look for a sensational program of wildcatting in the Lower Cretaceous rocks of southern Mississippi and Alabama.

Top exploration people feel that recent discoveries are interesting, geologically, but little more. The reason: depth, unknown factors of permeability and porosity, and poor offset results in fields already found.

Cracked asphalts are finding more and more use as refinery fuels. With hot circulating systems and the proper burners, some refiners find their best outlets within their own gates. Some resort to this practice only in winter, but others are fueling crude stills and steam plants with cracked bottoms throughout the year.

Senate action on the Harris gas bill may be held off for some weeks. Strategy may be to pass some important bill in which northern Democrats are interested first. That may make them more friendly toward the gas bill, which is going to have a rough time anyhow.

Several new cracking catalysts are here—and more are on the way. Refiners are going to be offered a wider range of catalysts from which to select the types best suited to their specific needs.

State boundaries in the Gulf will be a big issue over the next few months. The Justice Department has set the stage for a test of Louisiana's 3-league claim. Florida is trying to settle its same problem informally. But if Louisiana is cut back to a 3-mile limit by the courts, look for similar action against Texas and Florida.

Refiners will be blending 50 per cent catalytic reformate to gasoline in the next few years.

This is going to aggravate the problem of fuel sensitivity—the spread between research and motor octane ratings. While alkylates and isomates will lessen the sensitivity problem, they cannot solve it.

The next move is Detroit's. Milder engines which do not penalize high research octane fuels are going to be needed.

Rubber consumption in the United States this year may drop as much as 25,000 tons under the 1,525,000 tons consumed in 1955.

But production of synthetic rubber may jump as much as 105,000 tons over last year's 1,030,000. A slowing down of automobile production around May or June is expected. Extent of the drop will be the significant factor.

the OIL AND GAS JOURNAL

JANUARY 9, 1956 • VOLUME 54 • NUMBER 36

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IN THE NEWS

Of General Interest:

Richfield Asks California Vote on Unitization 65
Esso Doubling Its Baton Rouge Research Center 65
Early Winter Tightens L.P.G. Supply 66
Stanolind Expands Well-Testing Lab 67
Demand, Imports, Production to Rise This Year 68
Pipeliners Tired of Paying Relocation Costs 70
Texas Truckers Win Revision of Tank-Truck Rates 71
"Peron Tainted" Assets May Be Confiscated 77
Russian Output Near 1,400,000 bbl. Daily 77
Union Dealing for Venezuelan Crude 77

Government:

Leasing of Wildlife Refuges Defended 61
Governors Urged to Support Harris Bill 64
Gas Bill and Imports Get Star Billing 67
Another Checkup on Imports Due 69

Drilling:

Oklahoma Producing-Depth Record Periled 64
Per-Foot Drilling Costs Drop Again in '55 66

Natural Gas:

Ratable Take for Gas Step Nearer in Texas 62
Culberson Has New Ratable-Take Plan 63

Processing:

New Auto Models Put Heat on Refiners 58
"Super Distiller" Improves Hydrocarbon Separation 61
Another Gasoline Plant Adds Reformer 72
Petrofina to Build Angola Refinery 74

Exploration:

Texota Finds Oil in Rank North Dakota Test 63
New Paluxy Pool Looms for East Texas 69
Stanolind to Start Exploring Jamaica 74
Texaco, California Standard Get Libyan Acreage 77
Center of Gravity Shifts to Dixie 147
Why Some Geologists and Geophysicists Don't Mix 148

OIL AND GAS PIPELINES • REFINING • PETROCHEMICALS
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TECHNOLOGY–OPERATION

Pipelining

Compressor Piping Design for Pulsation Control and Maximum Compressor Efficiency **80**

By James M. Sharp and Edward N. Henderson

An electrical analog computer is being used successfully to design and test compresor station piping. Results from work on 12 stations show that the analog method is superior to theoretical methods now in common use.

Pipeline Revenues and Throughputs, Third Quarter, 1955 **86**

Pipeline Patrol: Construction Tables **123**

Drilling—Production

Equipment for Water Flooding—2 **87**

By J. L. Eakin

Here is brief description of the equipment used for treating produced brine for injection.

Where to Drill With Air **91**

By Ed McGhee

This article tells how and where Permian basin operators are using air drilling. Contractors can save money by drilling loss-of-circulation zones with air, but water-shutoff methods are not available. The question then is one of predicting where there is a long section of hole with no water.

How to Use Air Drilling Successfully **93**

By M. M. Brantly

Here's a summary of the various factors that must be considered and a concise listing of do's and don'ts.

Packaged Compressors in Gasoline Plants **96**

By J. W. Hendryx

Field usage has proved these units to be quite practical. They seem to be economical, and about 50 per cent salvageable.

Refining—Processing

W.P.R.A. Refining Panel: Questions and Answers on Refining Problems **99**

Here are some pertinent questions and some detailed answers on refining problems encountered in catalytic cracking, catalytic reforming, how to make octanes, alkylation, coking, and treating.

Propanes to Nitroparaffins **110**

By John C. Reidel

Commercial Solvents Corp. is now making some 10,000 lb. per year of nitroparaffins, at its Sterlington, La., plant.

On The Job—In The Plants: Top Efficiency From Refinery Burners **115**

By Robert D. Reed

Here is a discussion of the factors which enter into the determination of how much maintenance the refinery burner needs.

Foreman's Page **117**

Equipment Design and Operation **119-120**

Costimating **121**

Questions on Technology **122**

General Interest

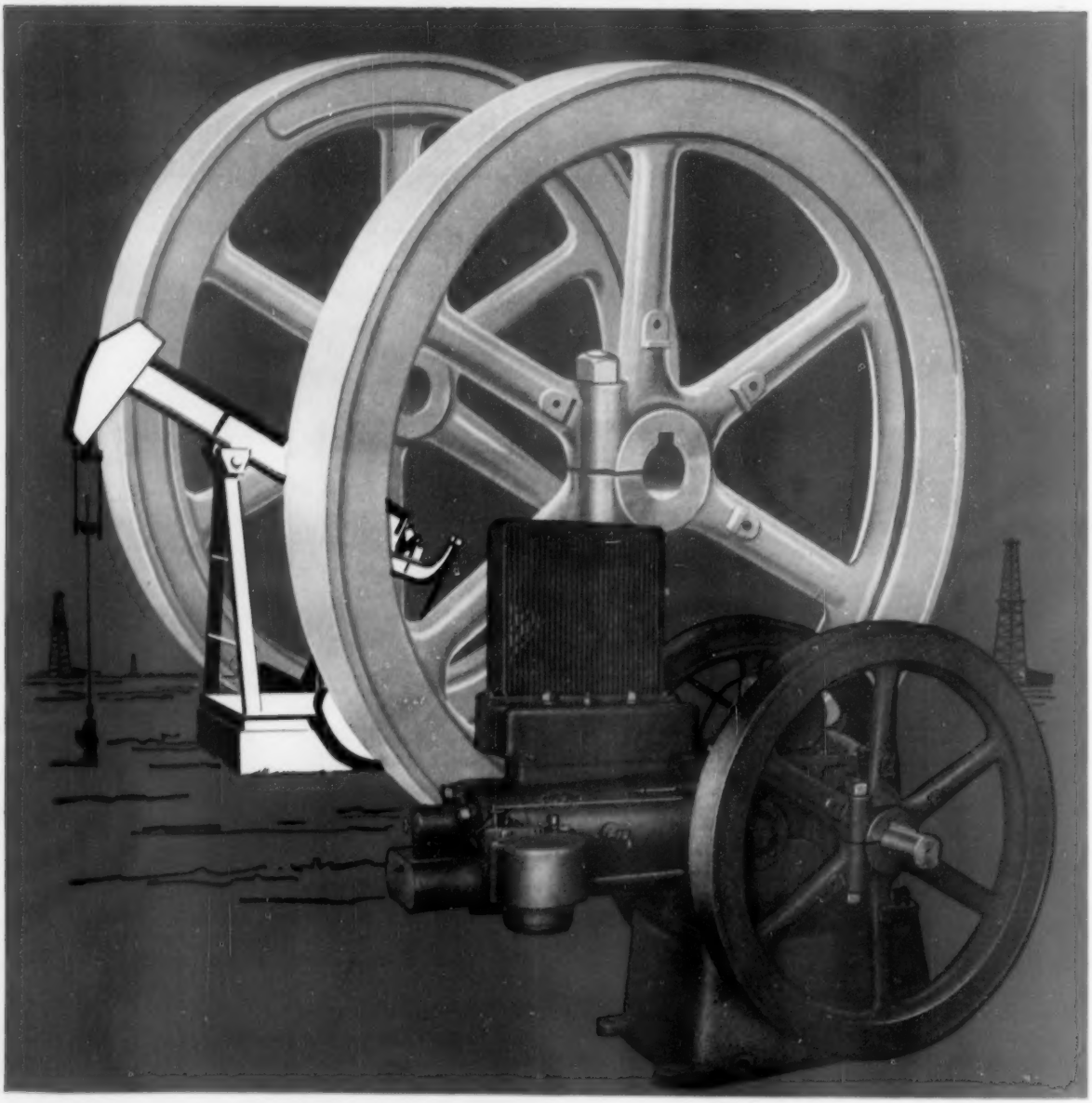
How to Read Fast **89**

By Dr. Nila Banton Smith

Maybe Microfilm and Punch Cards Can Solve Your Filing Problems **108**

DEPARTMENTS

A Glance Ahead	1	Books	116	Statistical Summary	163
They Say	44	Pipeline Patrol—Construction	123	Drilling Statistics	164
Calendar of Events	49	Drilling Contractors	131	Supply Statistics	165
Journally Speaking	53	Equipment Digest	135	Refining Statistics	166
Editorial	55	Trade Literature	139	Markets	167
This Week	57	Equipment Men in News	141-172	Monthly Summary	168
Watching Washington	71	Exploration Highlights	151	Classified Advertising	169
International News	74	Personals	160	Advertisers' Index	173



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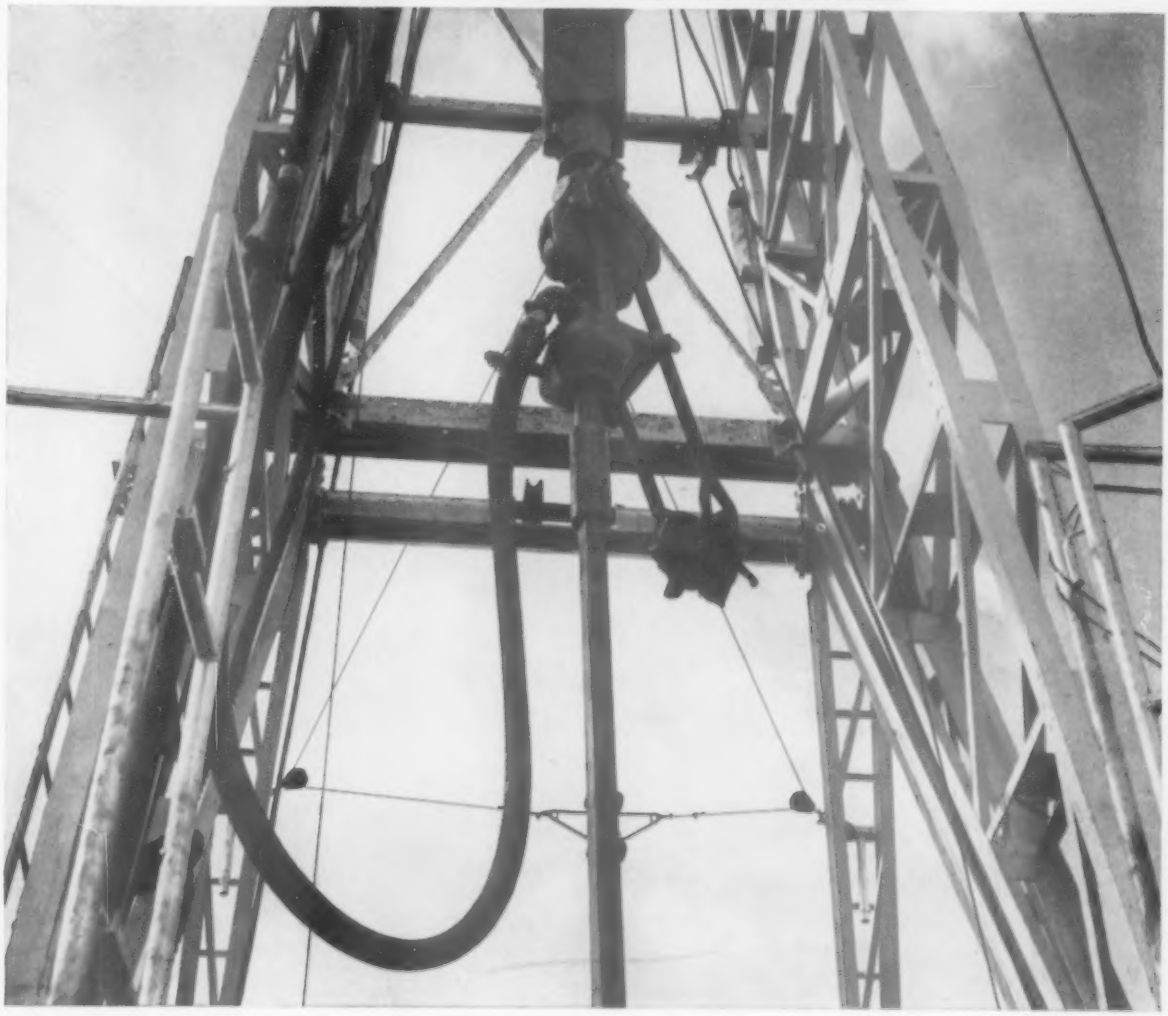

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This B. F. Goodrich hose has all the strength it takes to handle extreme bottom hole pressures. Spiral-wrapped cable wires make it resistant to bursts, qualify it for Grade C (5000 lb. test pressure) American Petroleum Institute. Hose ends are reinforced with additional plies of wire and fabric to protect against bending stress at the couplings. Extra strength here means extra safety for your crew and rig—no hose blowouts at the coupling.

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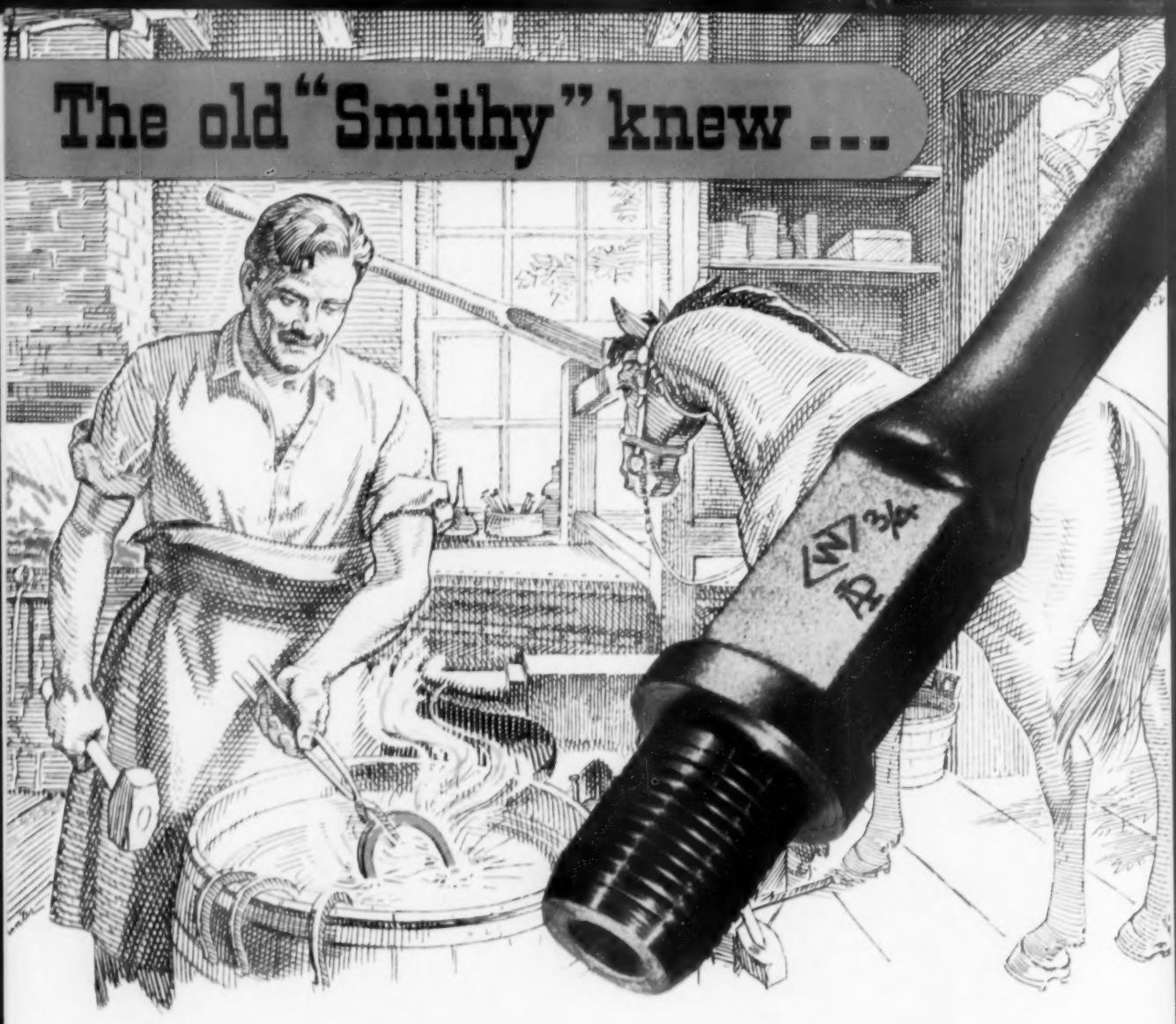
B.F.Goodrich
INDUSTRIAL PRODUCTS DIVISION

The old "Smithy" knew ...



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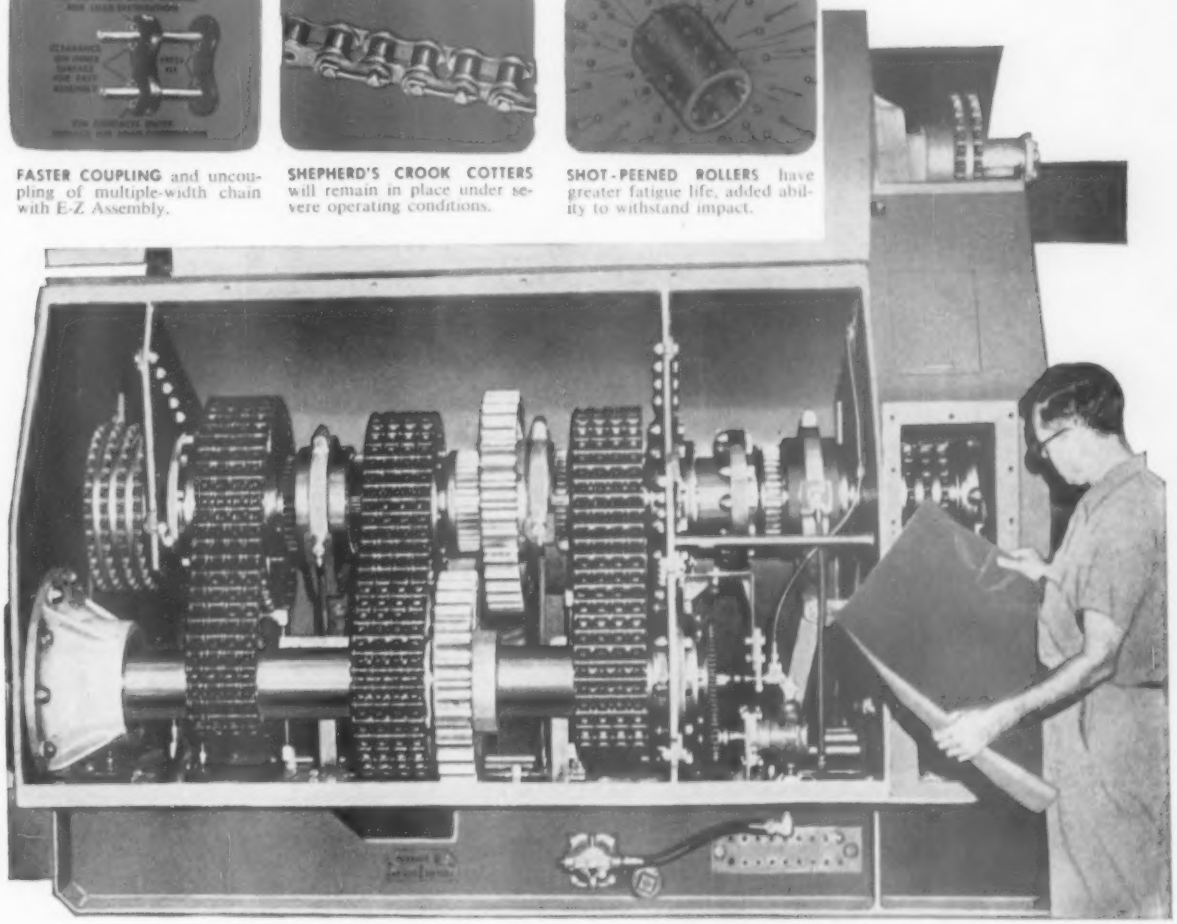

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Side boom action is hydraulically operated so you can lift and lower with smooth, accurate control. Only two controls operate the boom. Even the inexperienced operator becomes an expert in a short time. Investigate the *low cost* of this unit and its many profit-making advantages. See your Oliver Industrial Distributor.

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THE OLIVER CORPORATION
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A complete line of industrial wheel and crawler tractors

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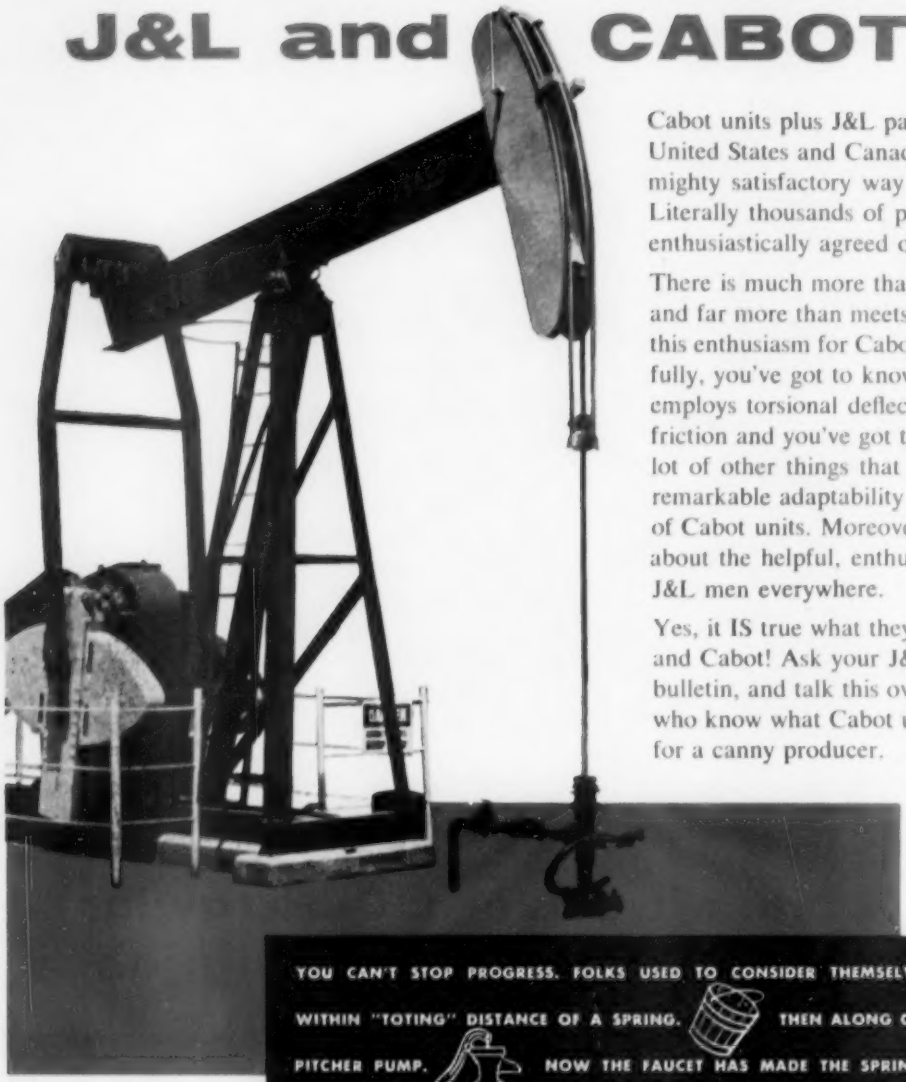

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133-M

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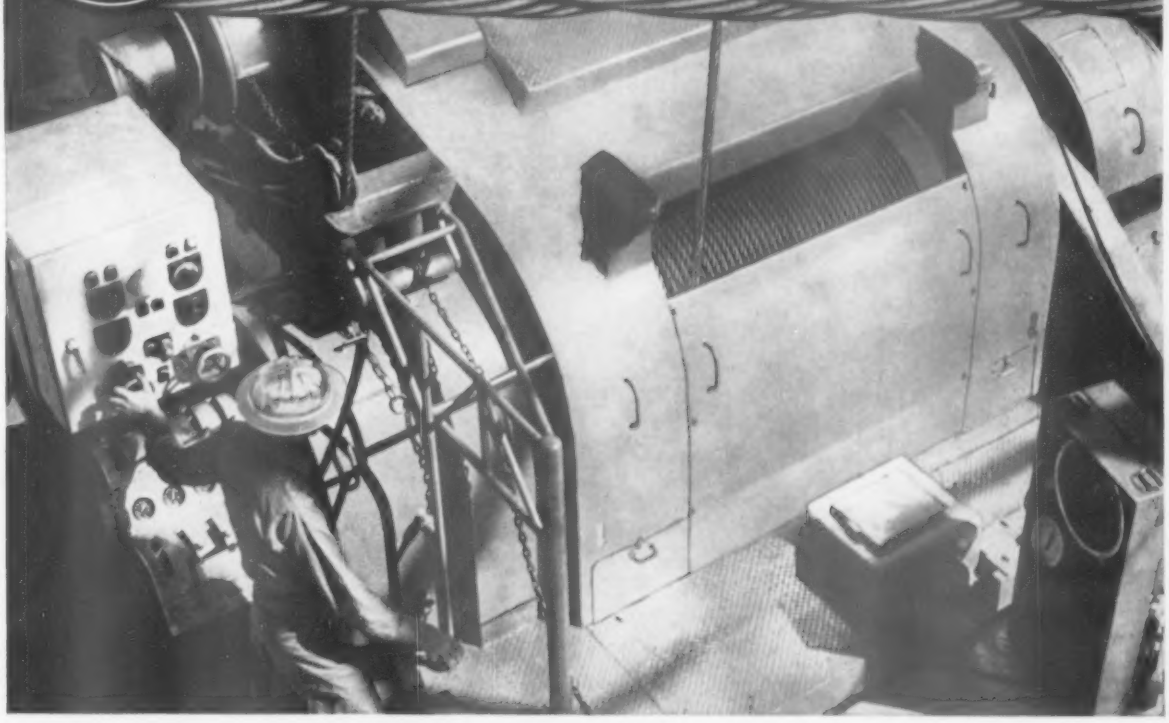

Drill Deeper and Faster with New VHS Rotary Drilling Lines

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With new VHS, you can drill deeper before increasing the number of parts of line. You can make round trips faster. Increased speed eliminates the necessity for buying new blocks or regrooving sheaves to use larger diameter lines for higher safety factor.

Tougher

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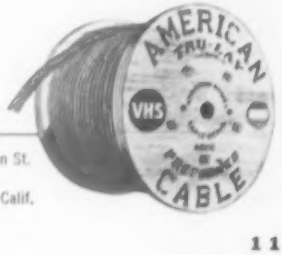

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DH-30
NEW DH-35
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DH-45

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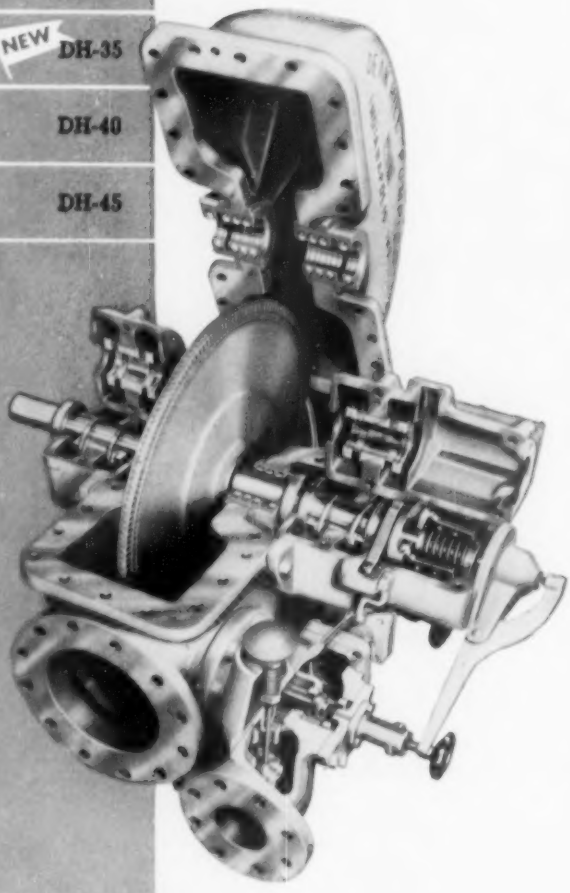

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- Easy Adjustment To Within Close Limits For Any Pressure Within Its Output Range.
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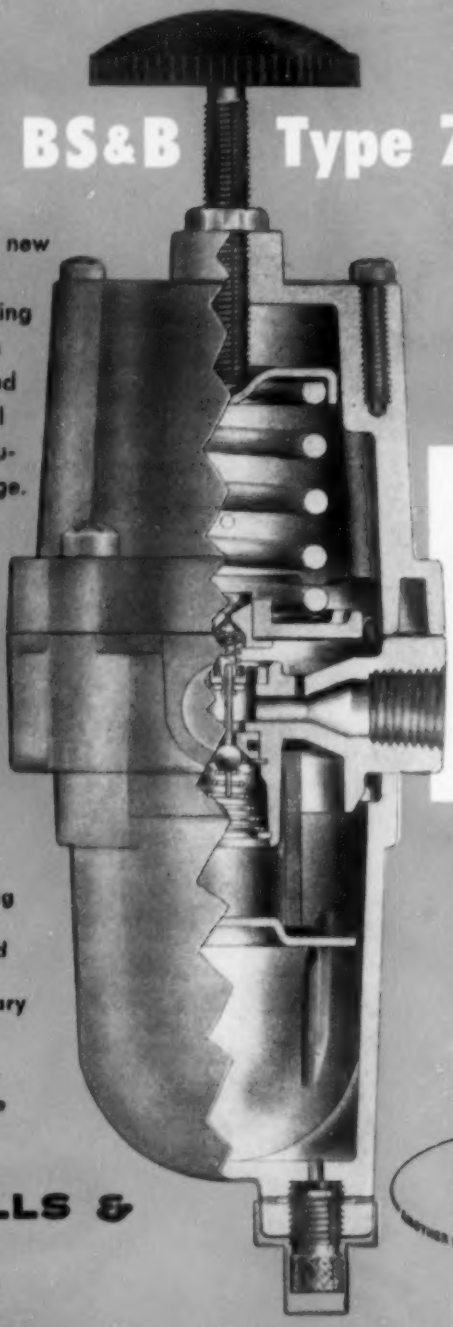
- Available With Or Without Auxiliary Pressure Gauge.

For complete information, contact your BS&B Representative, or communicate directly with . . .



1/4" Pipe Connections

40 PSI — Maximum Reduced Pressure (100 PSI with Special Spring)

300 PSI — Maximum Input Pressure

10 CFM — Maximum Capacity

BS&B

ANOTHER EXAMPLE OF PRODUCT LEADERSHIP

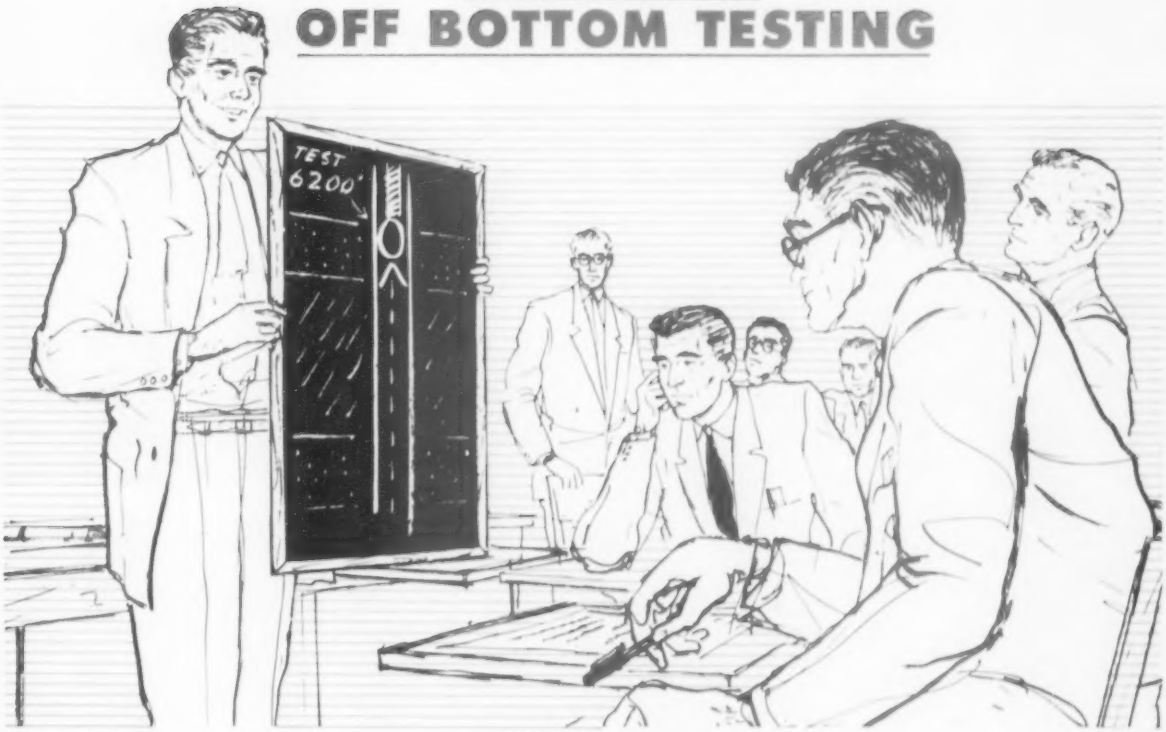
BLACK, SIVALLS & BRYSON, INC.

Controls Division, Dept. 4-A1
7500 East 12th Street, Kansas City 26, Missouri

ACCURATELY TESTS ALL UP-THE-HOLE FORMATIONS

Halliburton's New

OFF BOTTOM TESTING



Another Big Reason Why Halliburton's Best In Drill Stem Testing

Did you drill through some possible pay? This new technique can accurately test all up-the-hole formations.

Off Bottom Testing isolates the zone from formations either up or down the hole—regardless of location in the well. Two Expanding Shoe Packers are set firmly against the wall—one above and one below the zone to be tested—providing a tight seal from both directions.

Eliminates Long Anchor Pipe

A Sidewall Anchor Assembly supports drill pipe weight applied to packers, eliminating the need for long anchor pipe. It saves the rig-time required to make-up and break-out the anchor, avoids the possibility of sticking it, or of kinking it from excessive column loading.

Off Bottom Testing is accurate as well as easy—the string includes Halliburton's famed Hydro-Spring Tester and Bourdon Tube Pressure Recording Device. Insist on this technique when there's possible pay up-the-hole, get accurate evaluation of all formations. Call your local or district office of the Halliburton Oil Well Cementing Company.

ADDITIONAL DATA SENT ON REQUEST *Get this valuable information for your Halliburton Service File*

HALLIBURTON
TESTING SERVICE

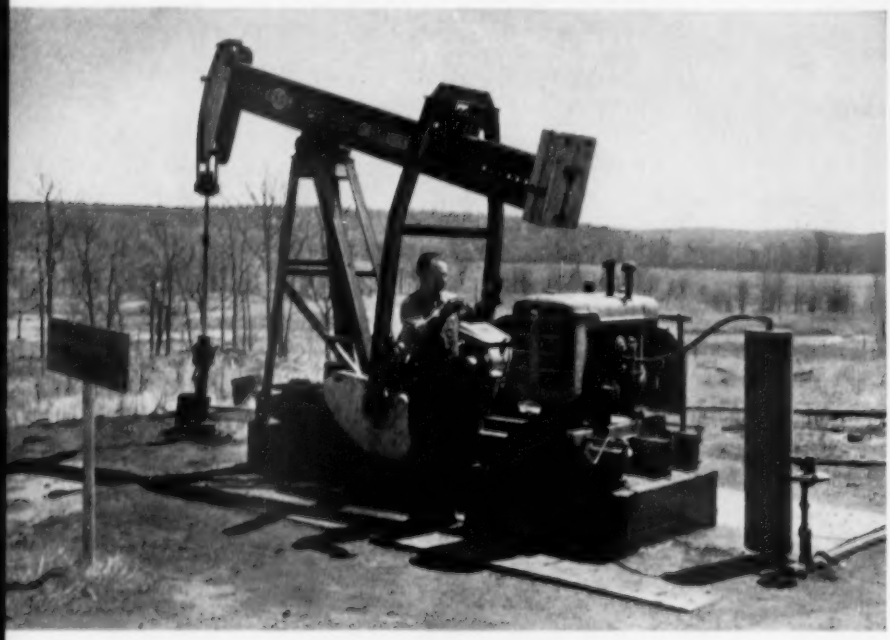
250 SERVICE CENTERS—JUST MINUTES AWAY FROM ANY RIG

A PICTURE REPORT OF

INTERNATIONAL POWER *in action!*

Boosting job production everywhere

6 years, no overhauls—TD-14 with Superior Pipe-Boom, rear right, was bought by Luther Harper, Turley, Oklahoma pipe-layer, in 1949. In 10,000 hours since then, it has needed no major overhauls. TD-14, with Superior Boom, foreground, newest of Harper's 6 International crawlers, was bought for this job—laying 3½ miles of 12 inch gas line in East Tulsa. Last year, Mr. Harper's 6-unit IH fleet put in or removed 160 miles of pipe, some 24 inches in diameter.



120 IH engines for L. B. Johnson, used by this Kiefer (Okla.) company on wells near Tulsa. Here, Master Mechanic Joe Vanardel inspects a 24 hp U-2A which pumps a 1700-ft. well. "International engines are easy to work on and low in maintenance cost," he says. "Some of our units haven't needed any work in 4 years. Others, on continuous hard-pumping wells, easily run a year, 24 hours a day, between overhauls."

Contract-drilling in Louisiana, Lloyd & Langston report the 83 hp butane-burning International engine which powers their drill rig "has needed no repairs in 2 years of use." Rig is shown drilling 3500-ft. well at Hosston.

Digs oil reserve pit—That's just one of many tasks Dick Sieber Excavating Co., Pauls Valley, Oklahoma, assigns their 4 TD-14's. "New TD-14's provide solid comfort," says Operator Lloyd Nelson. "I can really relax in the big, soft seat. Operation is simpler too. Controls are handy—right where I can reach them naturally. And I'm sure going to appreciate the open deck on those hot days next summer!"

Welds 55 mi. gas line—two 40-volt welders on TD-14 provide power for stringing line, Seneca, West Virginia, to Woodstock, Virginia. Pipeline Construction & Drilling Company, Camp Hill, Pennsylvania, weld 2,500 feet daily with this rig.

Clears 50-ft. right-of-way—Clearing on same job described left is being done by TD-24 shown, plus 2 TD-18's and 2 TD-9's. Despite rough, rocky, mountainous terrain and 4500-ft. altitude, fleet clears an average of ½ mile per day.

"Best for backfilling" says R. M. Paylor, Pipeline Construction & Drilling Co. foreman, of International Drott TD-9. "It has highest reach and best balance of any equal-size loader. Hydro-spring sure saves wear in rough rock work."

International

INTERNATIONAL HARVESTER

Industrial Power

A machine size for every job . . . see your nearest INTERNATIONAL DISTRIBUTOR for details.

PAYSCRAPERS
13 yds. and 18½ yds.

SUPERIOR PIPE-BOOMS
4 Models . . . 60 13,100 to 90,500 lbs.

CRAWLER TRACTORS
8 Models . . . 40 to 200 hp

DIESEL, GAS ENGINES
13 Models . . . 16½ to 296 dhp

Also: International Drott Loaders . . . International Wheel Tractors . . . International Scrapers, Bottom-Dumps . . . Wire Rope and Other Supplies.

The Case where ONE Tube is BETTER than TWO...

PARKERSBURG HORIZONTAL SEPARATORS:

The large single-tube design of the Parkersburg Horizontal Separator gives you advantages in oil-gas separation unmatched by two-tube designs. It assures maximum efficiency because it provides, in a greater degree, all the elements that are essential to optimum separator performance; viz, separating oil and gas; degassing the oil; de-oiling the gas; automatic control of the flow.

All of these advantages are the result of:

1. GREATER GAS FLOW AREA which provides about 20% more area for primary separation... 20% greater area to slow the velocity of the stream.
2. GREATER INTERFACE AREA increases opportunity for liquid to give up maximum amount of gas.
3. LONGER RETENTION TIME in the single-tube Parkersburg Separator provides further opportunity for gas to be released from the oil.
4. NO-BLEED LIQUID LEVEL CONTROLLER operating on hairline precision, and with extreme sensitivity to liquid level changes, assures trouble-free, accurate flow control.

Your Parkersburg Representative will submit detailed information on sizes and capacities of the Parkersburg Horizontal Separators, from which to select the unit to meet your separating conditions.

Parkersburg

RIG AND REEL COMPANY

DIVISION OF PARKERSBURG : AETNA CORPORATION

3345 WINTHROP AVENUE
FORT WORTH 16, TEXAS

5512

How high load capacity is built into less space in Dodge-TIMKEN All-Steel pillow block

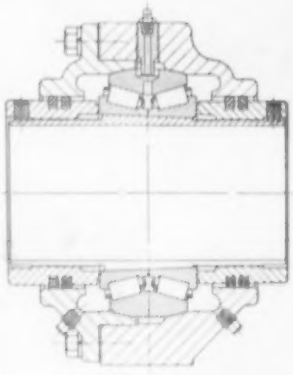
THIS rugged Dodge-Timken pillow block packs more capacity in less space than ever before. All-steel construction gives it extra strength and durability. The design is compact. No special thrust devices that take up extra space are needed—the two-row Timken® tapered roller bearing takes *both* radial and thrust loads in any combination. And full line contact between the rollers and races assures high load capacity.

The cutaway view below shows the bearing. It is of special design, with tapered bore and self-aligning spherical outer surface—never requires adjustment. As in all Timken bearings, races and rollers are case-carburized and have tough, shock-resistant cores under hard, wear-resistant surfaces. Under normal conditions, the Timken bearing will last the life of the machinery with which the pillow block is used.

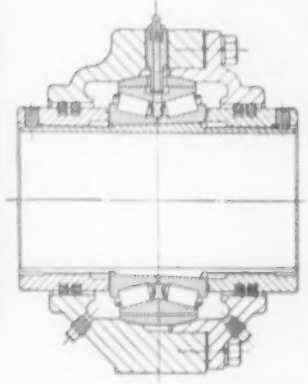
In addition to the all-steel pillow block shown here, Timken bearings are also used in the Type "E", Double-Interlock, Type "C", and Special-Duty pillow blocks—other versatile pillow blocks in the Dodge-Timken line with a wide variety of uses in industry.

To be sure of the finest bearing steel, we make our own—America's only bearing manufacturer that does. No other bearings can give you all the advantages you get with Timken bearings. Include them in your design plans... specify them for the machines you buy or build. Look for the trademark "Timken"—it's on the bearing that makes any machine run better. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable: "TIMROSCO".

This symbol on a product means its bearings are the best.



How **DODGE MANUFACTURING CORPORATION,** Mishawaka, Ind., mounts Timken bearings in the Dodge-Timken All-Steel pillow block. Above: non-expansion block with fixed bearing. Below: expansion block with floating bearing.

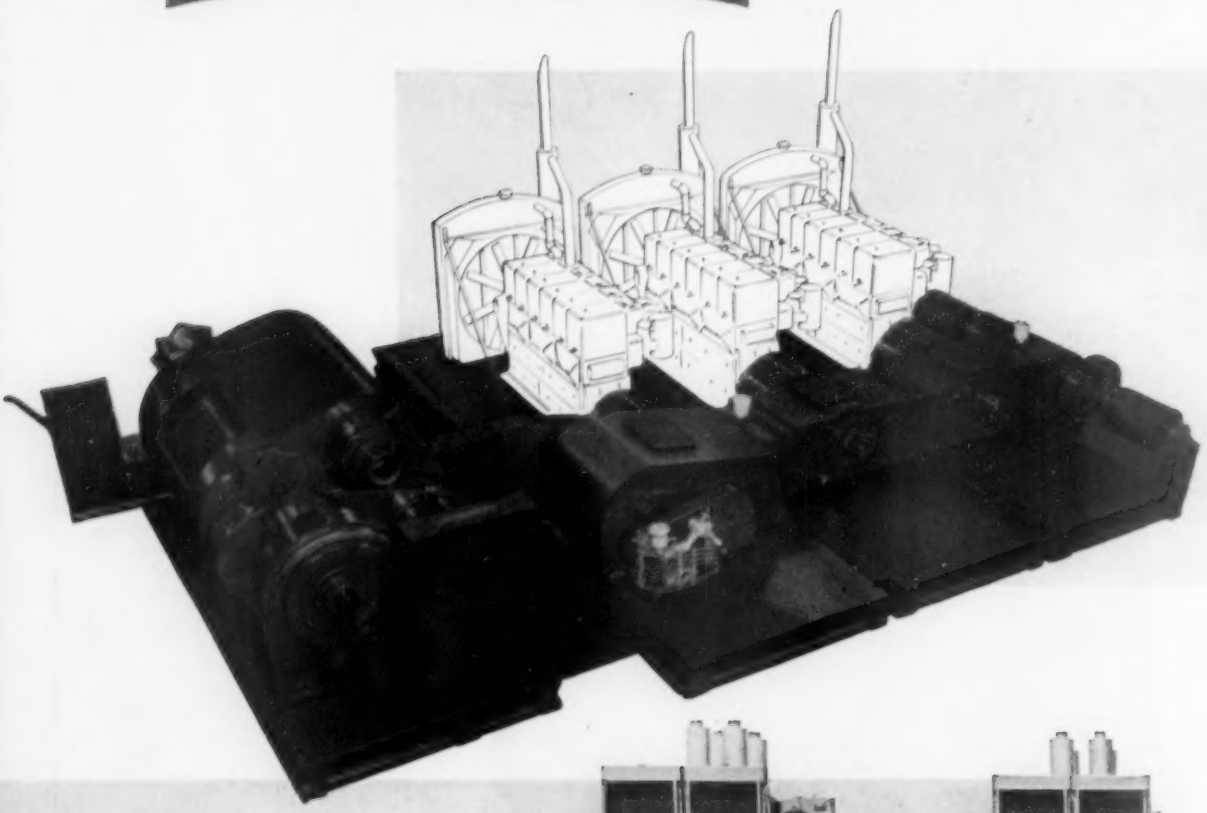


TIMKEN

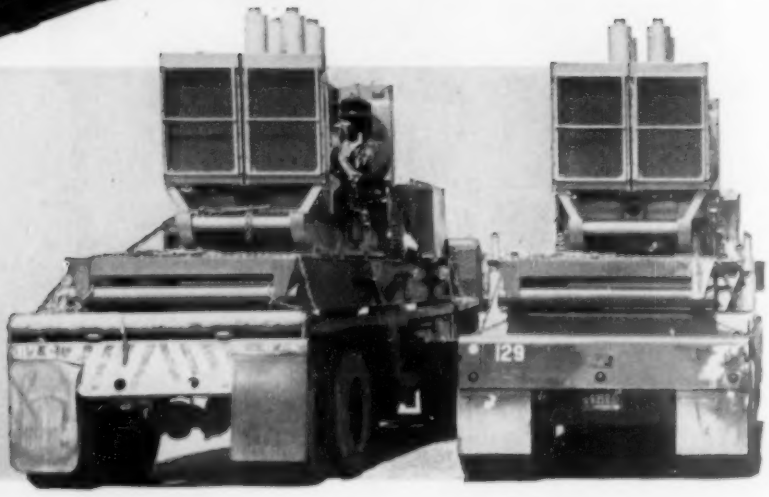
TAPERED ROLLER BEARINGS

NOT JUST A BALL ○ NOT JUST A ROLLER ▭ THE TIMKEN TAPERED ROLLER ▭ BEARING TAKES RADIAL ◊ AND THRUST ◊ LOADS OR ANY COMBINATION ✳

EMSCO proudly presents



Ships easily on 4 Trucks



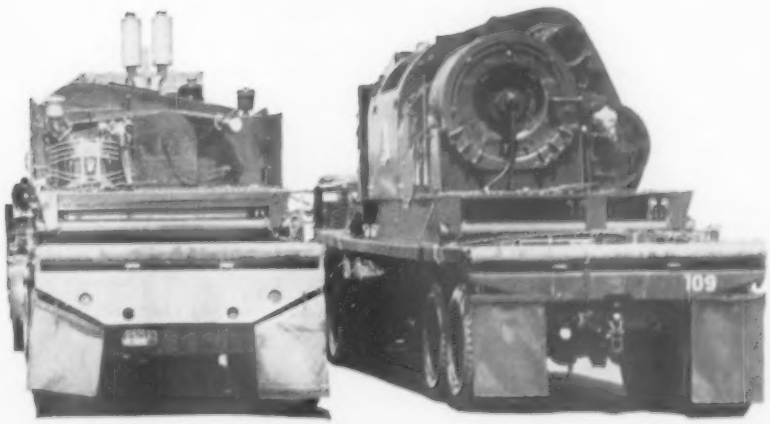
The operator will save time with a new friction-compounding clutch between No. 1 and No. 2 engines when he operates No. 1 engine separately to drive the rotary. No time lost shifting jaw clutches when a connection is made.

Controls are in a separate slide-mounted console which can be pulled out for use and pushed in for moving. A highly effective lubrication system with a true oil filter of the cellulose type will continuously filter about one-sixth of the oil circulated.

the new A-800 RIG

- Designed for medium to deep wells, the new EMSCO A-800 Rig fills a long felt need for greater portability in 4 packages, each of proper road dimensions, plus maximum power and economy.
- Incorporates many new and improved features. The selective transmission is in the No. 1 engine package, and the output shaft of the sectional type compound and the input shaft of the selective are one and the same.
- Can be powered by any three drilling engines having a total power output of 1,000 h.p. Engine to transmission drives may be Fawick clutch, torque converter or hydraulic coupling.
- Auxiliary brake is permanently mounted on the drawworks skid. Brake cooling system is vastly simplified, cooling more efficient, and volume far greater, with water passing through both rims in one end of the drumshaft and out the other.

For best service with the A-800 Rig, we recommend the use of EMSCO P-20½ and PJ-20½ Rotary Machines, R-44-6 Crown Blocks, R-44-5 Traveling Blocks, and L-300 Swivels.



Note how easily the EMSCO A-800 Rig can be shipped, as shown by the four convenient packages, each designed to fit on a truck. These four convenient packages can be rapidly and easily assembled.

Call CONTINENTAL for complete information on the new EMSCO A-800 Rig which offers so many advantages.

CONTINENTAL

Serving the Oil and Gas Industries

CONTINENTAL SUPPLY COMPANY

A Division of The Youngstown Sheet and Tube Company

General Offices, Dallas, Texas

Representatives in all principal oil fields of the world

EMSCO

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EMSCO MANUFACTURING COMPANY

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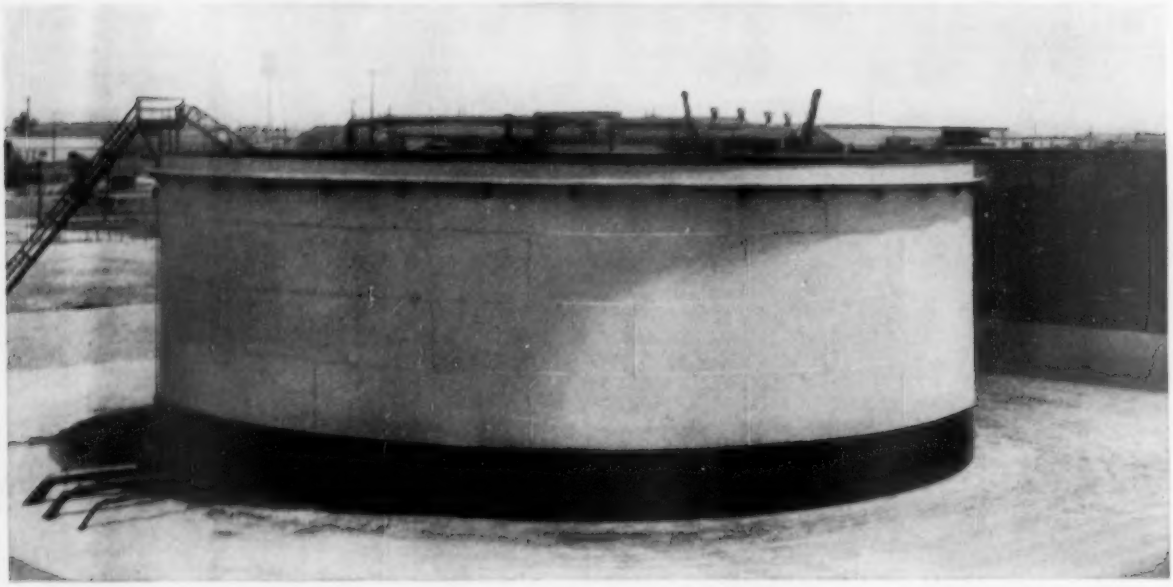
GRAVER ... *a conservation design to fit every need*



GRAVER® CENTER-WEIGHTED FLOATING ROOF TANK ...ideal for jet fuel storage

This Graver design is ideally suited for storage of jet fuels, gasolines, and other volatile liquids—especially where inclement weather is a problem. Rain water runs to the center of the roof and is carried off through a sump. The deck is clear and uncluttered, facilitating easy snow removal.

The Center-Weighted Floating Roof is unusually stable, being built to principles basic to ship hull design. Since the roof floats directly on the product, vapor losses are minimized.

Graver builds this and other tank designs to suit your specific needs.

For the utmost in economy and performance you can do no better than to contact Graver. Our engineering representatives will consult with you at no obligation.

GRAVER TANK & MFG. CO., INC.

East Chicago, Indiana

CHICAGO • NEW YORK • PHILADELPHIA • EDGE MOOR, DEL. • CATASAUQUA, PA. • PITTSBURGH
CLEVELAND • DETROIT • TULSA • SAND SPRINGS, OKLA. • HOUSTON • ODESSA, TEXAS
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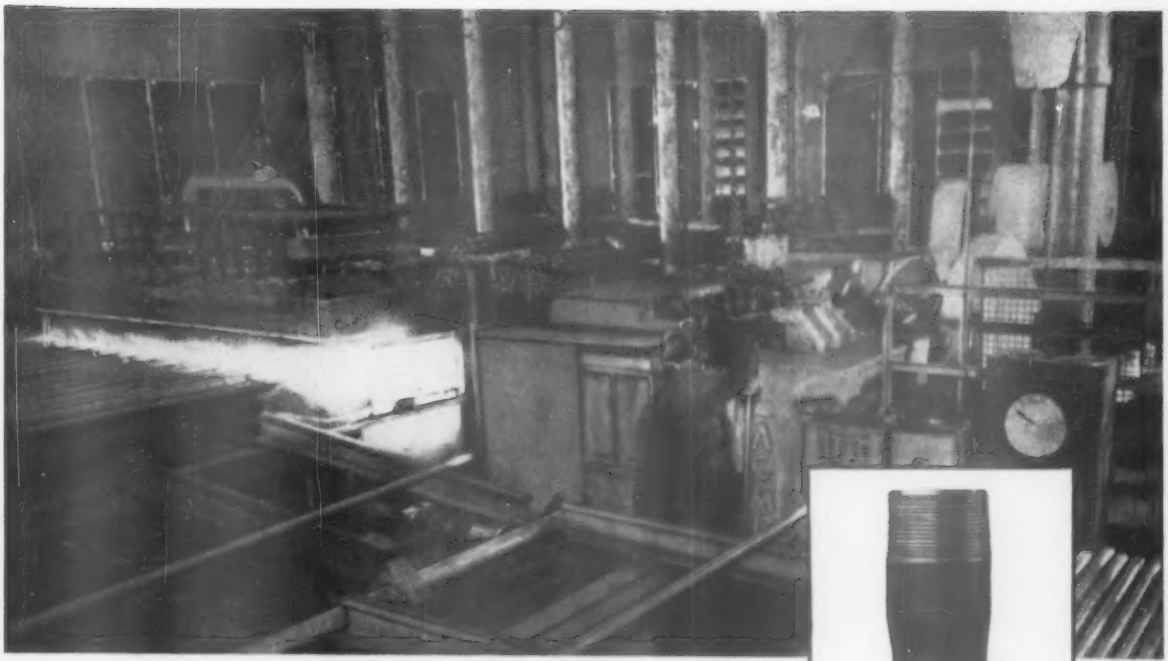
For THE UNITED STATES NAVY, GRAVER built these Center-Weighted and Double-Deck Floating Roof Tanks.



UPSETTING gives CF&I SEAMLESS TUBING extra strength where it's needed most

The tremendous strain imposed on oil tubing joints, especially near the top of the well, demands exceptional strength. Since threading weakens tubing at the joints, a special forging process known as "upsetting" was devised to increase the O. D. of the tube ends without altering the inside diameter—to provide greater well strength at the joints.

At CF&I's upsetter, both ends of the tube are heated to forging temperature, upset and allowed to cool. When required by specifications the tube is normalized. Then the ends are faced and chamfered.

After inspection, the tubing is sent to the threader. Thread protectors and couplings are applied, tubing is sorted for length, tested and coated for delivery.

Rigid manufacturing standards, testing and re-testing, are typical of the care CF&I exercises from mine through manufacture. Thus, in CF&I Seamless Oil Country Casing and Tubing (available in sizes 2⅜" through 9⅝" O. D.), you are assured materials that meet or exceed standards set by API Specification 5A.

SEAMLESS TUBULAR PRODUCTS

THE COLORADO FUEL AND IRON CORPORATION

DENVER, COLORADO

CF&I

3372

KELLOGG
Sinclair-Baker
Reforming

Dark Horse
in the
Reformate
Race...

New Process and New Catalyst Promise New Records in Production of Low Cost, High Octane Reformates

Although the M.W. Kellogg, Sinclair-Baker process is still too new in service to provide any long-term performance data, and customers' initial findings cannot yet be disclosed, many economic advantages of this catalytic naphtha reforming process have already been firmly established. Any refiner faced with increasing octane yields from present feedstocks, or with getting high octane reformates from lower grade naphthas, will recognize the significance of the following points . . .

Quick Start-Up

Experimental operation is reduced to a minimum. One M. W. Kellogg reforming unit was started on its final test run within two weeks after the catalyst was first charged to the reactors—with octane rating and yield during this 15-day period well in excess of the guarantee.

A Regenerative Catalyst

Sinclair-Baker Platinum Catalyst RD-150 can be regenerated easily and quickly *in situ* to provide many operating cycles, each of many months duration, with negligible loss in catalyst activity. Cost of catalyst per pound in terms of barrels of reformate produced is a major economic factor of the process.

Long Catalyst Life

Sinclair-Baker regenerative catalyst RD-150 has high activity and long initial life. It has been in operation for over one year without supplementing the catalyst. 95 octane reformate can be produced for six months or longer before regeneration is required.

Octane Level

Depending on the feedstock, clear octane ratings above 90 are now being obtained commercially—with 100, and even better, a goal that is entirely feasible and economically practical. *Variability* of octane rating is the keynote of the process, permitting selection of the exact processing conditions for a given naphtha to secure optimum economic operation at all times.

Supply of Catalyst

Use of the process does not obligate refiners to buy Catalyst RD-150 beyond the first year's requirements, although a continuing source of supply can be assured. This freedom from long-term purchase and license agreements is an important consideration when deciding which is the most suitable reforming process.

Low Grade Naphtha Feeds

M. W. Kellogg's unique design permits the effective desulphurization of low grade naphthas as part of the process, and avoids corrosion and metal contamination. Kuwait naphthas thus treated, for example, can produce yields of high octane reformates only slightly lower than those for higher grade Mid-Continent feedstocks.

For More Information

Further details on M. W. Kellogg's catalytic naphtha reforming process, the Sinclair-Baker catalyst, together with some economics of both, are contained in a recent booklet, "Low Cost Production of 95 Octane Clear Reformate." Copy sent on request.

Refinery Process Division

THE M. W. KELLOGG COMPANY

225 Broadway, New York 7, N. Y.

The Canadian Kellogg Company, Ltd., Toronto • Kellogg International Corp., London

SUBSIDIARIES OF PULLMAN INCORPORATED

WHITLEY COLLINS

Portrait by Fabian Bachrach

"Over 80% of Northrop personnel buy U.S. Savings Bonds . . ."

"Our recent Payroll Savings Campaign at Northrop demonstrated the belief of our personnel and our company in the basic fundamentals of American good citizenship—staunch support of our Country and personal thrift.

"At the completion of the campaign we had over 17,000 regular savers—over 80% of all Northrop personnel buying U. S. Savings Bonds regularly on the Payroll Savings Plan. Every employer should stage a similar campaign for the benefit of his personnel and the economic welfare of our Country."

WHITLEY COLLINS, ***President***
Northrop Aircraft Company

If less than 60% of your personnel are Payroll Savers, do something about it. A phone call, telegram or letter to Savings Bonds Division, U. S. Treasury Department, Washington, D. C., will bring prompt assistance from your State Director. He will help you install, or revitalize a Payroll Savings Plan, through a simple, person-to-person canvass which your personnel will be glad to conduct. That's all you have to do—your men and women will do the rest.

The United States Government does not pay for this advertising. The Treasury Department thanks, for their patriotic donation, the Advertising Council and

THE OIL AND GAS JOURNAL
TULSA 1, OKLAHOMA

and now **THE NEWEST!**

FLUID END VIEW
HP-18000

POWER END VIEW
HP-18000

HP-18000 7¾" x 18"
DUPLEX POWER SLUSH PUMP

750 HORSEPOWER **at 60 RPM. Weight 36,377 lbs.**

1322 lbs. mud pressure with 7¾" liner, 2,700 lbs. mud pressure with 5½" liner.

WHELAND

THE WHELAND COMPANY, CHATTANOOGA, TENN., U. S. A.
ROTARY DRILLING MACHINERY

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Solve Your Winter Lease Problems

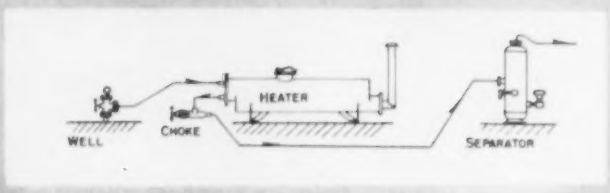
with

MALONEY-CRAWFORD INDIRECT HEATERS

Maloney-Crawford Indirect Heaters are made of the best of materials with a furnace which is easily removed for inspection and repair. These heaters will help you solve such problems as heating high pressure oil lines to reduce oil viscosity; heating long product lines from field to refinery; heating corrosive oil and the three applications given below:

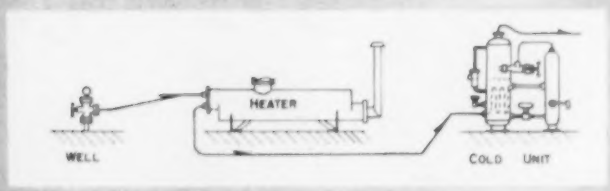
PREVENTING SEPARATOR FREEZE-UP

Heater replacing heat lost from gas stream to atmospheric cooling, or by pressure reduction, or both. When pressure reduction is necessary, the body of the choke can be submerged in the warm water bath of the heater to prevent freezing across the choke. The gas heating coil can be split into several passes, if desired, for interpass choking or heating of more than one stream.



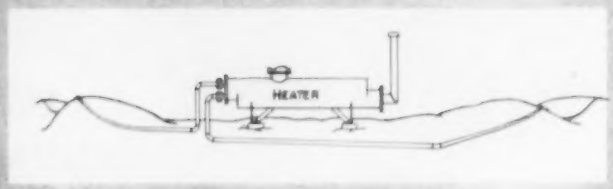
MAINTAINING BATH TEMPERATURE OF LOW TEMPERATURE SEPARATORS

Heater adding heat to well stream, to be transferred to the cold separator bath by the bath heating coil. This heat is required for melting gas hydrates formed by the cold separator operation. Usually most of the required heat is supplied by the well stream, with a small heater being used for make-up heat needed due to severe cold weather or decreases in the well flowing temperature.



HEATING GAS TRANSMISSION LINES

Heater adding required heat to assure safe temperature for transporting gas through the lines without freeze-up. This is usually done on relatively short lines carrying gas from a field to a central dehydration plant, or to a gasoline plant.



MALONEY-CRAWFORD TANK & MFG. CO.

Factory and General Office: 38 North Peoria—Box 659, Tulsa, Oklahoma

Export Representative: Baird Lines, 1037 Grand Central Terminal, Bldg., New York 17, N. Y.

Canadian Representative: Maloney-Crawford Tank & Service Company, Ltd., Edmonton, Alberta, Canada

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MALONEY-CRAWFORD TANK & MFG. CO.

FOR DEPENDABLE POWER,

YOU CAN'T BEAT GM DIESEL

FOR DEPENDABLE SERVICE,

YOU CAN'T BEAT STEWART & STEVENSON

The new Drilling Barge Tender "Geo. Falgout" is 125 feet long by 30 feet beam by 9 feet draft. It is certified to carry 450 tons of liquid or dry cargo.

One of two 600 hp GM 6-110 tandems installed in the "Geo. Falgout." Auxiliary electric power is supplied by two 30 KW Stewart & Stevenson marine type generator sets.

THIS MAKES IT 33

Stewart & Stevenson Services have now furnished 33 GM Diesels in the offshore exploration and production fleet of Falgout Boat Company, Inc.

T. J. Falgout, President, has tried many makes of engines during the last twenty years. He now uses GM engines and Stewart & Stevenson Service exclusively because, he says "you can't beat that combination for dependability and economy."

STEWART & STEVENSON SERVICES, INC.

Main Office and Plant:	4516 Harrisburg Blvd., Houston 11, Texas. Phone CApitol 5-5341
Branches:	Corpus Christi, Dallas, Lubbock, San Juan, Odessa.
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THE NATION'S LARGEST DISTRIBUTORS OF GM DIESEL ENGINES

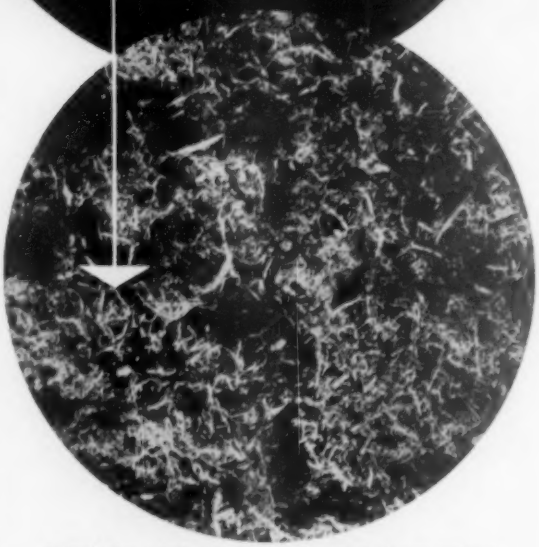
Palco® Seal

PROVED THROUGH 20 YEARS

for effective prevention of circulation losses

Men in the field like the easy-to-handle 40-lb. bags, quick dispersal of *Palco Seal* through the mud, and the way it stays in suspension and flows freely through pumps.

When successful drilling organizations re-order a product year after year, you *know* it's doing its job in the field. And when these orders continue to come from every major producing area where thief formations and porous conditions are encountered, you can be sure that the product has extremely universal effectiveness. We could tell you how the combination of slender and chunky fibers of *Palco Seal* form a lasting densely matted caulking barrier—how inherent qualities of fibers manufactured from age-old California redwoods resist deterioration—how *Palco Seal* mixes readily, disperses thoroughly, remains in suspension, and pumps easily with the mud. But the real proof of performance and dependability lies in the continually growing demand for *Palco Seal*, not for one year or two, but for 20 years!



Actual size photograph of *Palco Seal* shows unique combination of slender and chunky fibers which quickly caulk up porous formations and form dense, interlocking matted barriers. Rigid control of manufacturing processes maintain uniform range of fiber length, size and low moisture content.

Now available in loose-filled 40-lb. bags for easy handling. Also available in 80-lb. bales.

DEVELOPED THROUGH PALCO RESEARCH

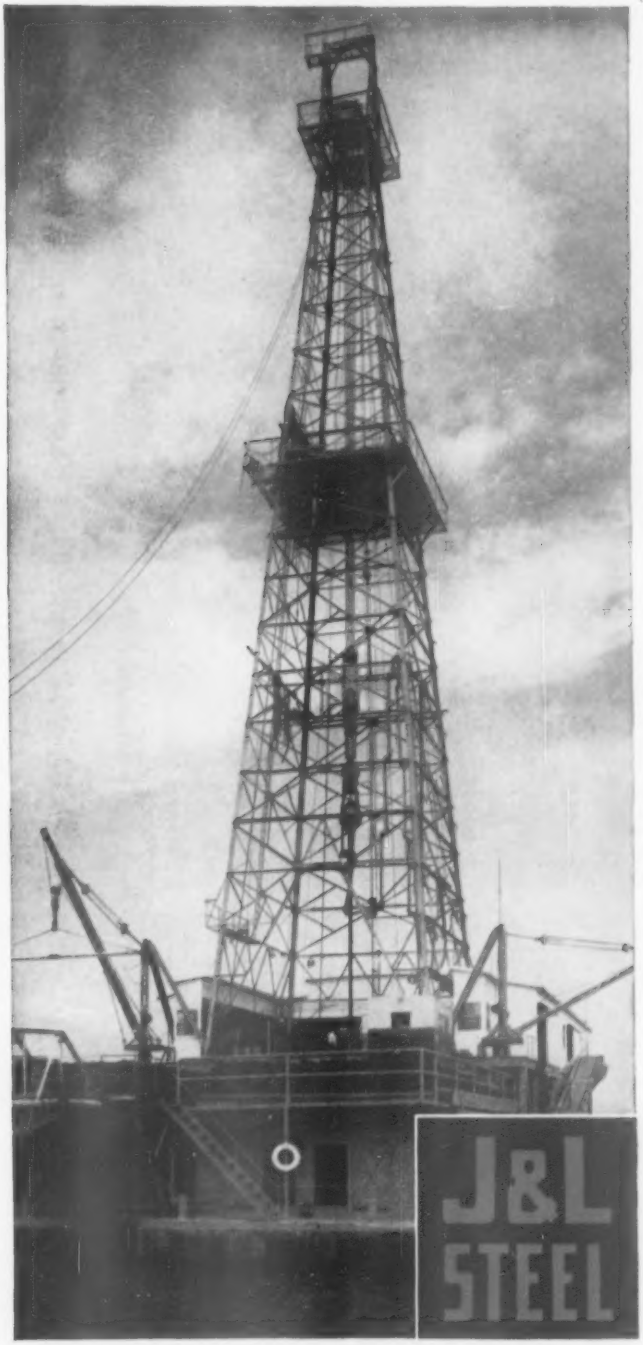
WRITE FOR BULLETIN No. 4-02 describing the properties, operating advantages, and composition of Palco Seal.

Available through oil field and mud service organizations.

THE PACIFIC LUMBER COMPANY

100 Bush Street, San Francisco 4, California

WORLD'S DEEPEST OIL WELL!



Richardson & Bass Drilling Rig No. 25 at well known as Richardson & Bass (Louisiana Account)—John W. Mecom—Freeport Sulphur Company—Humble-Louisiana Land & Exploration—State Lease 2414, No. 1-L. Rig and boilers are mounted on two huge barges sunk to bottom of marsh to provide firm foundation for operations.

Record depth of over four miles attained in Richardson & Bass Louisiana Well using J&L Drill Pipe and J&L Wire Rope exclusively

Wednesday, November 9, 1955, marked another milestone in the spectacular history of the oil industry. On that day, Richardson & Bass and their associates in this enterprise, John W. Mecom and Freeport Sulphur Company, broke the world's record for deep drilling in their well in Plaquemines Parish, Louisiana, 35 miles southeast of New Orleans.

This well, now more than four miles deep, has penetrated the earth to depths never before explored. Pressures are being encountered to which drill pipe never before has been subjected.

In discussing this new world's record well, J. E. (Ed) Hill, General Manager of Richardson & Bass Drilling and Producing Interests, said: "This well has been drilled from the surface to its total depth without a single pipe failure, a tribute both to the skill of the drilling crews, and to the quality of the pipe used."

Every foot of the drill pipe in the well is J&L Drill Pipe. To a depth of 13,655 feet, J&L Blue Ribbon Drill Pipe was used. From that point to the bottom, the string was replaced with J&L Blue Ribbon Vanadium Drill Pipe. Every foot of the wire rope which supports the entire four mile string of drill pipe is J&L Permaset Wire Rope. Hundreds of tons of J&L Casing have been set in the well, with additional hundreds of tons standing by for use when the well is completed.

To provide the high strengths needed in oil country tubular products for today's deep well drilling, J&L developed and has in operation extensive new finishing facilities—facilities which are already being expanded to keep pace with the oil industry's growing needs.

Interesting facts about world's deepest well

(As of November 28, 1955)

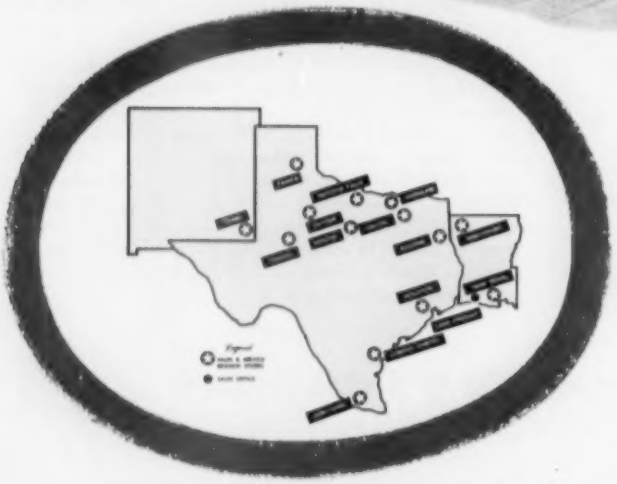
Total depth 22,209 ft., nearly 4¼ miles, equal to height of 15 Empire State Buildings . . . previous record depth 21,482 ft. . . . drilling began February 26, 1955 . . . total drilling time 205 days . . . total testing time 71 days . . . total elapsed time 276 days . . . bottom hole pressure 20,650 lbs. per sq. inch . . . bottom hole temperature 350° F. . . . time required to pull entire string of drill pipe to surface, replace bit and reset pipe is about 11 hours . . . stretch in drill pipe at extreme depth is about 20 feet . . . total cost of well estimated at between $1¼ and $2 million.

Jones & Laughlin
STEEL CORPORATION — *Pittsburgh*

TWO THINGS that guarantee you genuine Waukesha Parts

. . . the Waukesha Sales & Service, Inc., emblem on the uniform of the man from whom you buy your parts and on the truck that delivers them.

Your Waukesha engine will give its best performance **only** when fitted with genuine Waukesha parts. So always look for the Waukesha Sales & Service, Inc., emblem when you purchase replacement parts. Waukesha Sales & Service, Inc., branches and sales points, located throughout the oil country, carry complete stocks of engine parts, made to fit your engine and made to last, giving you the best possible performance from your Waukesha engine. So, remember the Waukesha Sales & Service, Inc., emblem the next time your engine needs a new part.



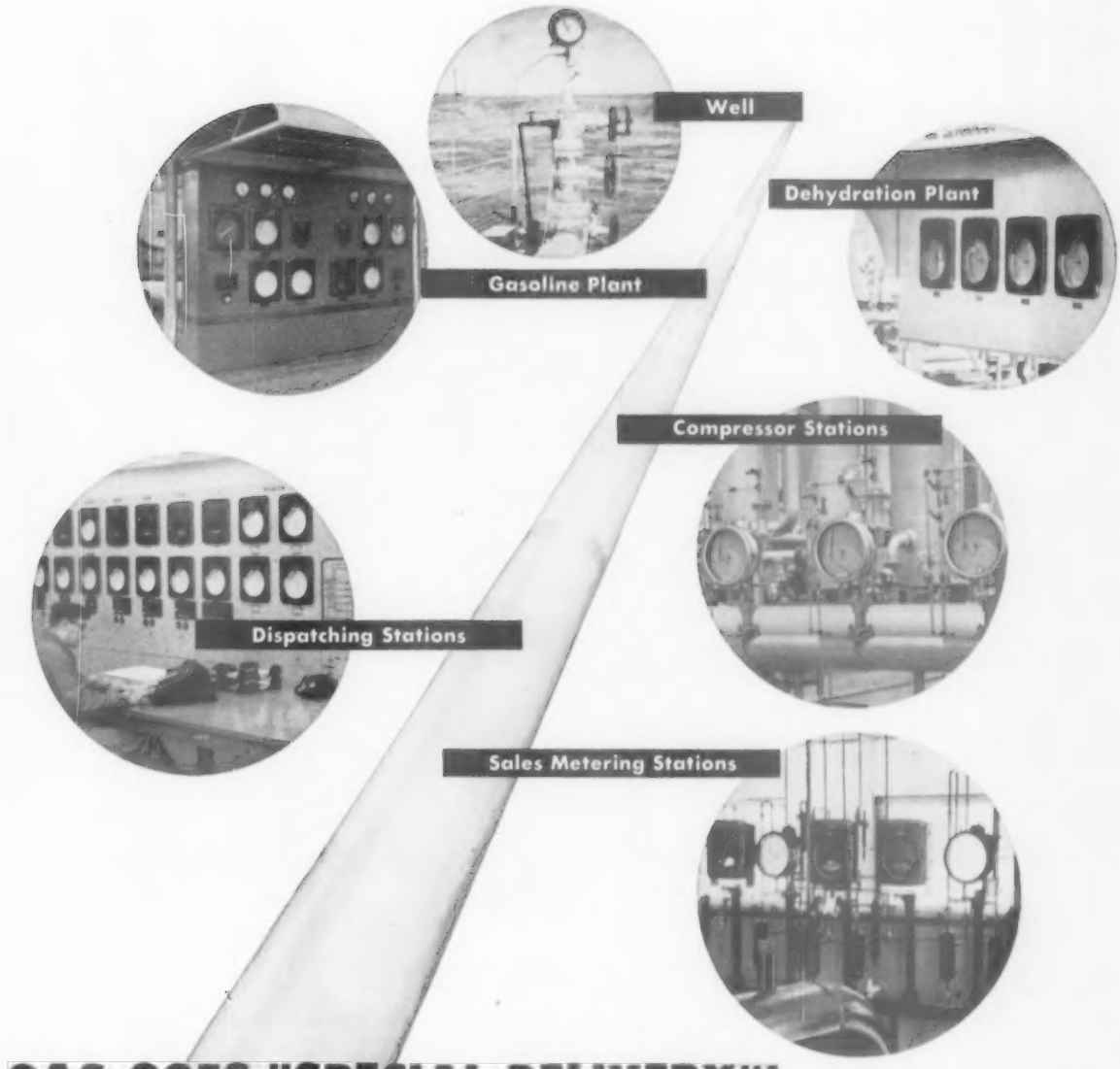
WAUKESHA

Sales & Service, Inc.

1422 MAURY ST. • HOUSTON, TEXAS

EXCLUSIVE DISTRIBUTORS FOR WAUKESHA PRODUCTS IN TEXAS, NORTH AND WESTERN LOUISIANA, SOUTHERN ARKANSAS AND NEW MEXICO

WORLD'S LARGEST DISTRIBUTOR OF OIL FIELD ENGINES



GAS GOES "SPECIAL DELIVERY"!

. . . under Foxboro Control

From well to city gate, natural gas flows more efficiently, with less supervision, in Foxboro-instrumented pipelines. At every stage — production — processing — transmission — delivery — Foxboro Instruments measure and automatically control gas movement and related operating variables. The resulting highly integrated control system keeps loads perfectly balanced . . . vital equipment constantly protected. For information on the latest methods of pipeline control, contact your nearby Foxboro Sales Engineer, or write The Foxboro Company, 601 Neponset Ave., Foxboro, Mass., U.S.A.

FOXBORO
Reg. U. S. Pat. Off.

Instrumentation for Pipelines

FACTORIES IN THE UNITED STATES, CANADA, AND ENGLAND

NEW MORLIFE* CLUTCHES

*TRADEMARK

and

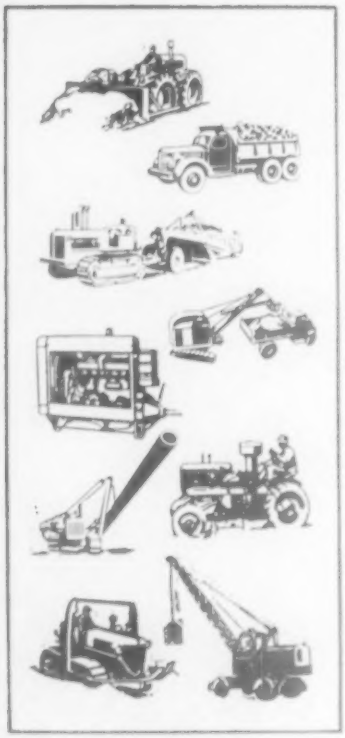
CLUTCH PLATES

Give—

100% MORE TORQUE GRIP
Reducing clutch size and engaging pressure

400% LONGER WORK LIFE
Operate longer without adjustment or plate replacement

50% BETTER HEAT DISPOSAL
Avoid down-time caused by burned or warped plates



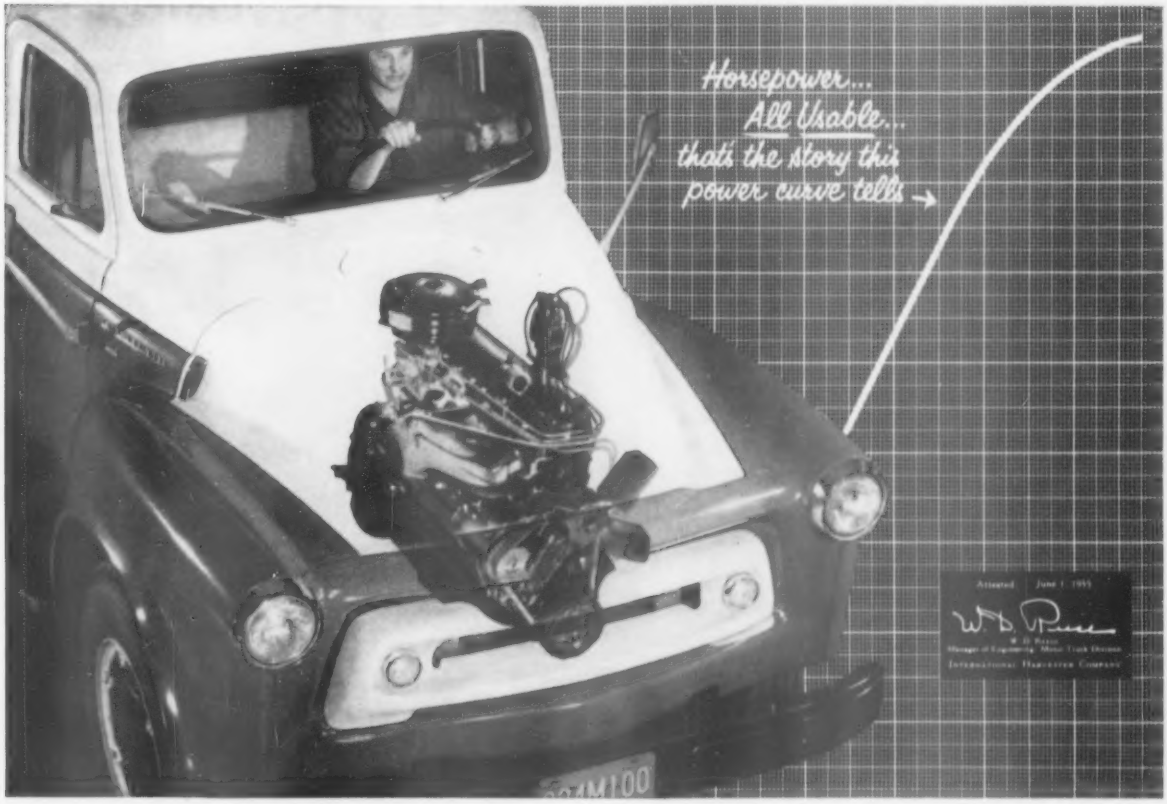
These NEW type ROCKFORD clutches have been developed and field tested by Rockford Engineers for heavy-duty clutch service. Because of their specialized characteristics, MORLIFE type ROCKFORD clutches are best suited for use in off-the-road machines such as tractors, trucks, tanks, cranes, shovels, bulldozers, earth movers, pipe layers, power units and other heavy duty equipment. For information how this NEW development will improve the operation and increase the on-the-job hours of your heavy-duty machines, write Department E.

B. W. ENGINEERING MAKES IT WORK
ENGINEERING
B-W
PRODUCTION
B. W. PRODUCTION MAKES IT AVAILABLE

ROCKFORD Clutch Division BORG-WARNER

1305 Eighteenth Avenue, Rockford, Illinois, U.S.A.

It's usable horsepower that counts!



Many passenger car type truck engines have to rev up to high speeds to pull their loads. They strain at the job—cost big money in wear and repair. INTERNATIONAL all-truck engines turn at relatively low rpm—deliver high usable horsepower at normal road speeds, for peak performance, long life, BIG money savings.

Internationals give you power without strain at safe, economical rpm to save you the BIG money!

Rated horsepower figures don't tell the whole story of truck performance.

Wise truck buyers want to know *more* than rated horsepower. They want to know what actual *usable* horsepower they are going to get to pull capacity loads at normal, legal speeds—without undue engine strain.

Usable horsepower—that's the point to keep in mind when buying trucks.

INTERNATIONAL engines deliver high usable horsepower at economical, wear-reducing speeds. Because they are built for use in *trucks*, with no compromise with passenger car design.

You get the usable power you need, plus longest truck life, every driver comfort and convenience. See your INTERNATIONAL Dealer or Branch for trucks exactly right for your job—all-truck built to save you the BIG money.

In the world's most complete truck line, there are trucks for every job. More than 200 basic models from 4,200 to 90,000 lbs. GVW—conventional and COE, 4-wheel, 6-wheel, four-wheel-drive—in thousands of variations for exact job specialization.

INTERNATIONAL HARVESTER COMPANY • CHICAGO

INTERNATIONAL TRUCKS

All-Truck Built to save you the BIG money!

Motor Trucks • Crawler Tractors • Industrial Power
McCormick® Farm Equipment and Farmall® Tractors

Texas oil companies prove the value of split channel radio operation

G-E narrow band equipment serves Loffland Brothers, Standard of Texas, and Seaboard Oil Company

In the Texas oil fields they'll tell you that *practical* split channel radio operation is proving its worth right now. Two major oil companies and a major drilling contractor, operating in an area pointing north from Odessa to Vealmoor and Snyder, have cooperated in establishing three independently operated systems in a range that formerly served two firms.

Rather than share a channel when Loffland installed radio in the area covered by Standard's 48.74 MC frequency and Seaboard's 48.78 MC allocation, the three firms decided to work on an experimental split channel basis. Slight modification of G-E equipment in use narrowed the spacing from 40 KC to 20 KC, permitting Loffland Brothers' new General Electric radios to go on the air on 48.76 MC.

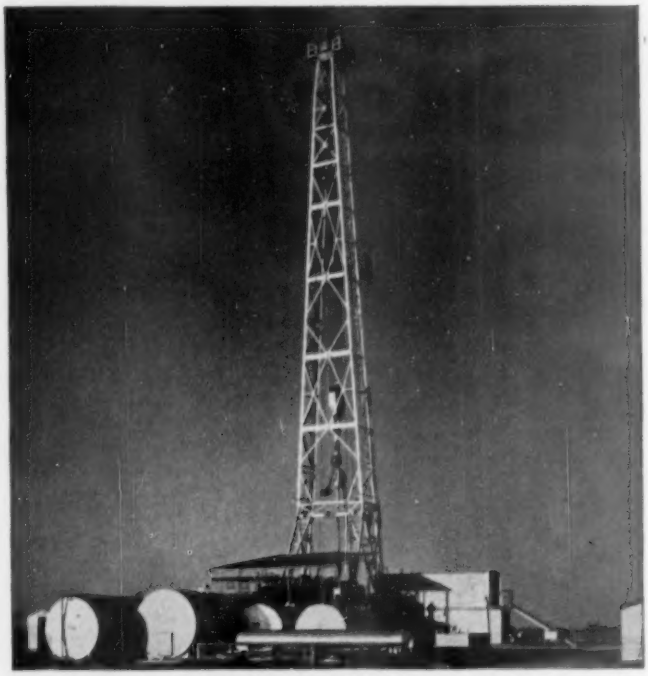
Clear channels for all

Now, each firm operates on its own frequency, without interference from either of the others. Because of split channel operation and General Electric narrow-band radio equipment, three companies benefit from 2-way radio communications without interference to one another.

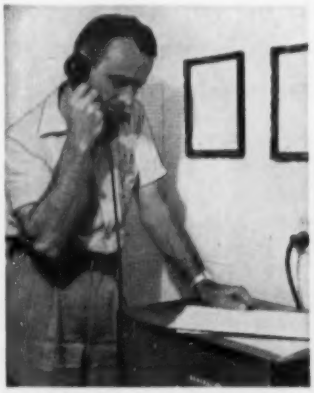
The new G-E Progress Line of 2-way radio equipment provides a complete interchangeable package. Transmitter, receiver, power supply, and optional chassis are individually rack-mounted. Plug-in design permits quick changes of frequency, power, or type of reception.

2-WAY MOBILE RADIO

Your General Electric Communications Counselor will be pleased to cooperate with you in planning a split channel operation for your company. Call him in, or write today to: *Section X816-9, General Electric Company, Communication Equipment, Electronics Park, Syracuse, New York.*



RADIO ANTENNA CAPS LOFFLAND BROTHERS' RIG near Odessa, Texas. Nine General Electric base stations and mobile radio units have cut $400 per month from former telephone costs.



STANDARD OIL OF TEXAS operates two G-E 60-watt base stations linking seven mobile units with the main base at Snyder, Texas. Radio speeds orders, makes instant decisions possible for fast action.

SEABOARD OIL COMPANY maintains instant operational contact with field locations through 5 G-E base stations. 20 mobile units coordinate widespread drill site activities in the West Texas area.

Progress Is Our Most Important Product

GENERAL ELECTRIC

BEAIRD-INGERSOLL-RAND

Packaged Compressor Plant

Lowest Cost Per Horsepower Installed

THE COTTON VALLEY OPERATORS COMMITTEE is adding these two Beaird-Ingersoll-Rand 6SVG 330 Horsepower Packaged Compressors to its Justiss Reservoirs Pressure Maintenance Station. Located six miles from the cycling plant, the station was initially equipped with one Beaird 300 horsepower packaged compressor.

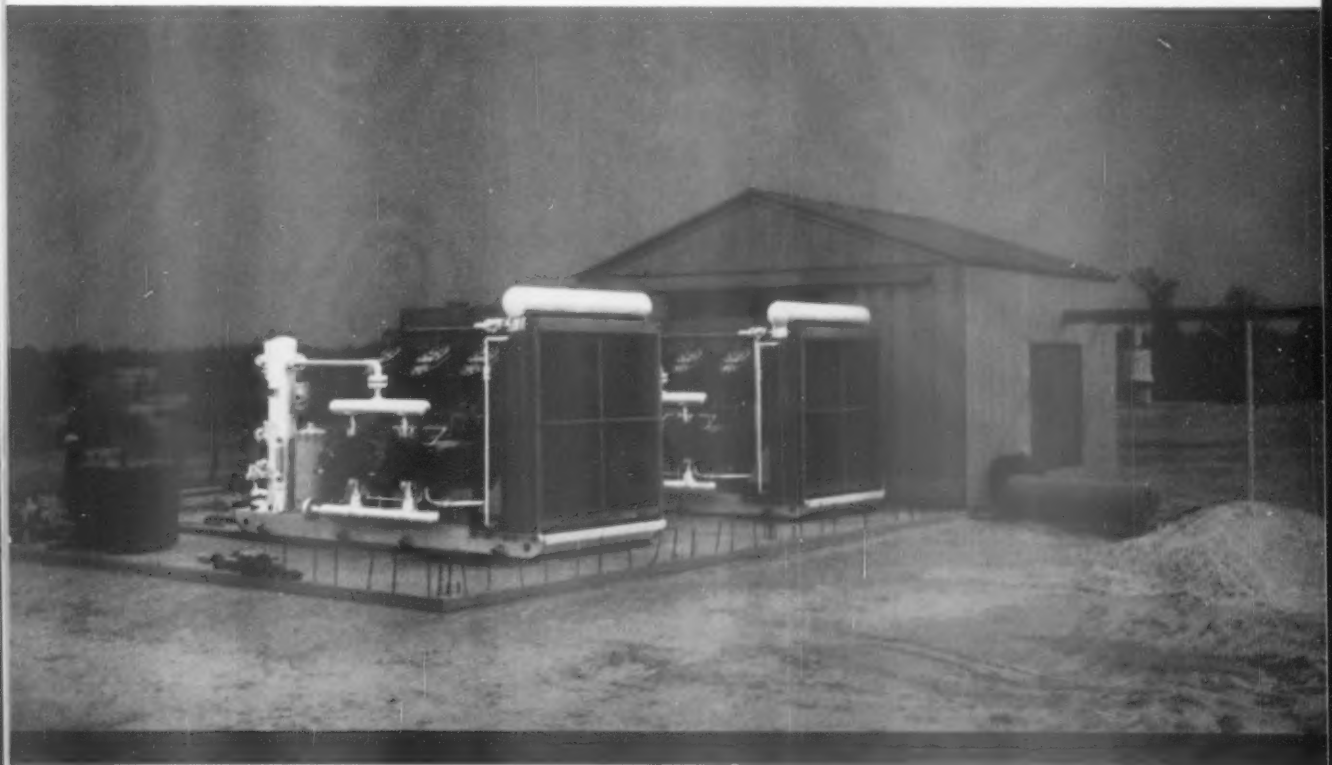
When the new units are placed on the line, the enlarged station will handle 24 mmcfd. Residue gas from the main plant will be picked up at 2000 psig and boosted to 4000 psig for injection into the reservoirs. As field operating conditions change, CVOC personnel will install new outer head plugs furnished with the units. The station will then be capable of compressing 29 mmcfd from 2500 psig to 4500 psig.

This on-the-job modification to the compressors will permit the production of the reservoirs to their final stages without compressor cylinder change. No additional operating personnel will be required as the units have been equipped with automatic controls that permit their unattended operation except for scheduled maintenance. Highly salvable, the entire installation can be moved to other service when the Justiss Reservoirs are depleted.

Let us show you how Beaird-Ingersoll-Rand packaged compressor plants can be designed to meet your special requirements.

High Pressure Injection —

PACKAGED COMPRESSORS FOR RESERVOIR PRESSURE MAINTENANCE



COTTON VALLEY OPERATORS COMMITTEE'S Justiss Reservoirs Pressure Maintenance Station—equipped with two Beaird-Ingersoll-Rand 330 h.p. 6SVG and one Beaird 300 h.p. 8XVG four cycle Gas Engine driven compressors, Young radiators and all necessary controls. Other sizes 110 to 660 h.p.

THE J. B. BEAIRD COMPANY, INC.

Shreveport, Louisiana

BEAIRD

MACHINING • MANUFACTURING • STEEL WAREHOUSE

PACKAGED COMPRESSOR PLANTS

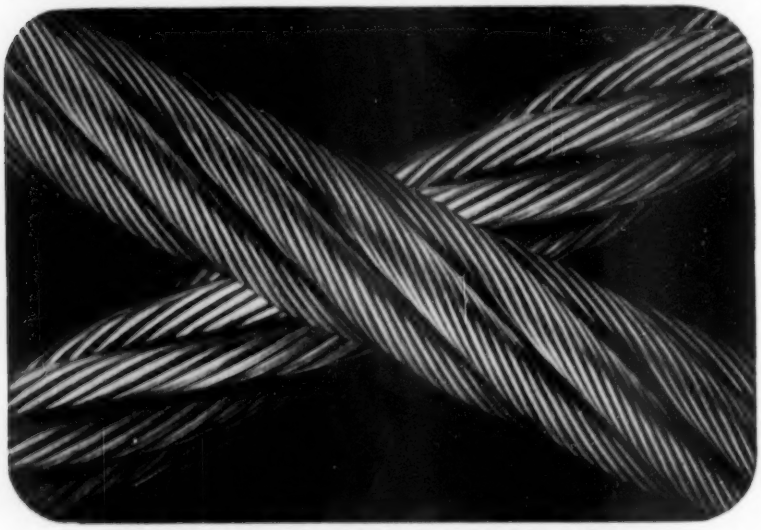
CAST STEEL FITTINGS

PRESSURE BULK STORAGE

ANHYDROUS AMMONIA EQUIPMENT

LP-GAS SYSTEMS

FIRST WE DEVELOPED 1105 ROPE WIRE.



THEN WE MADE ROEBLING'S

Royal Blue

WIRE 1105 ROPE

1105 takes Royal Blue out of the ordinary wire rope class.

1105 is a rope wire that's new—that's stronger. It's the biggest news in many years.

1105 is the result of more than a century of research and development—it's the wire that gives Roebling Royal Blue the stamina that pays off in service.

Contact your Roebling distributor or write us for the full story.

ROEBLING

Subsidiary of The Colorado Fuel and Iron Corporation

JOHN A. ROEBLING'S SONS CORPORATION, TRENTON 2, N. J. BRANCHES: ATLANTA, 934 AVON AVE. • BOSTON, 51 SLEEPER ST. • CHICAGO, 5525 W. ROOSEVELT RD. • CINCINNATI, 3253 FREDONIA AVE. • CLEVELAND, 13225 LAKEWOOD HEIGHTS BLVD. • DENVER, 4801 JACKSON ST. • DETROIT, 915 FISHER BLDG. • HOUSTON, 6216 NAVIGATION BLVD. • LOS ANGELES, 5340 E. HARBOR ST. • NEW YORK, 19 RECTOR ST. • ODESSA, TEXAS, 1920 E. 2ND ST. • PHILADELPHIA, 230 VINE ST. • SAN FRANCISCO, 1740 17TH ST. • SEATTLE, 900 1ST AVE. S. • TULSA, 321 N. CHEYENNE ST. • EXPORT SALES OFFICE, 19 RECTOR ST., NEW YORK 6, N. Y.

There's MORE rating selection available in Allis-Chalmers MOTORS

To meet refinery needs... Allis-Chalmers Offers Complete Line of Rib-Type Motors from 1 to 100 Hp

Made to order for refinery use, Allis-Chalmers explosion-proof, rib-type motors are available in ratings from 1 to 100 hp. The many cost-saving features of deep-rib construction can be applied in a variety of uses... both indoors and out.

Here's why these motors can cut refinery costs:

MORE cooling surface
Rib-type design provides reserve cooling capacity in dirty locations.

MORE iron
Cast-iron frame and external parts assure rigidity and resistance to corrosion.

MORE copper
A-C's greater use of copper increases electrical life.

MORE lubrication provisions
Provision made for in-service relubrication — important where corrosive vapors contaminate grease.

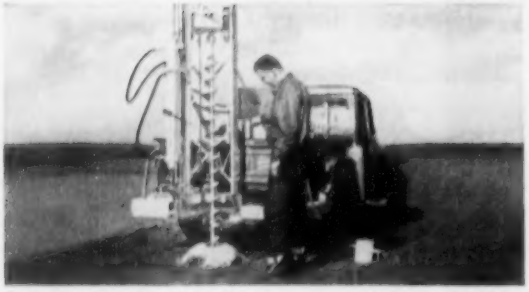
As a new machinery component or as replacement, specify Allis-Chalmers. To find out more, contact your nearby Allis-Chalmers distributor, district office, or write Allis-Chalmers, General Products Division, Milwaukee 1, Wisconsin.

A-4896

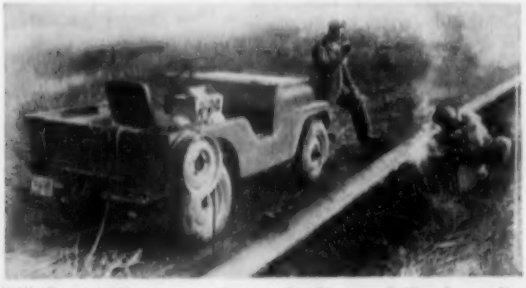
ALLIS-CHALMERS

Transportation. Rough country and bad weather are no obstacles to 'Jeep' vehicles. With the extra traction of their 4-wheel drive, they carry men, tools and equipment anywhere on the lease—shift easily into conventional 2-wheel drive for highway travel.

How 4-wheel drive 'Jeep' vehicles do your tough jobs...better!



Prospecting. The 'Jeep' Truck, with its go-anywhere 4-wheel drive, is ideal for drilling shot holes in remote places. With power take-off, it operates a mobile drill for borings as deep as 300 feet.



Mobile Power. With power take-off, the Universal 'Jeep' supplies power for welders and many other types of equipment. The 'Jeep'-welder unit follows the pipeline wherever it goes.

Out on the lease...along the pipeline...to the places the roads don't reach...'Jeep' vehicles carry men, tools and equipment. With the extra traction of their 4-wheel drive, they go cross-country through mud, sand and soft earth, and carry full loads up and down rough grades as steep as 60%.

More and more, the oil industry is using 'Jeep' vehicles with power take-off as a mobile power source for welders, compressors, generators, winches and a variety of other equipment.

Because 'Jeep' vehicles do an almost endless number of jobs... because of their long life and low-cost maintenance...they provide many opportunities for savings. See your Willys dealer for a convincing demonstration, or write for information.

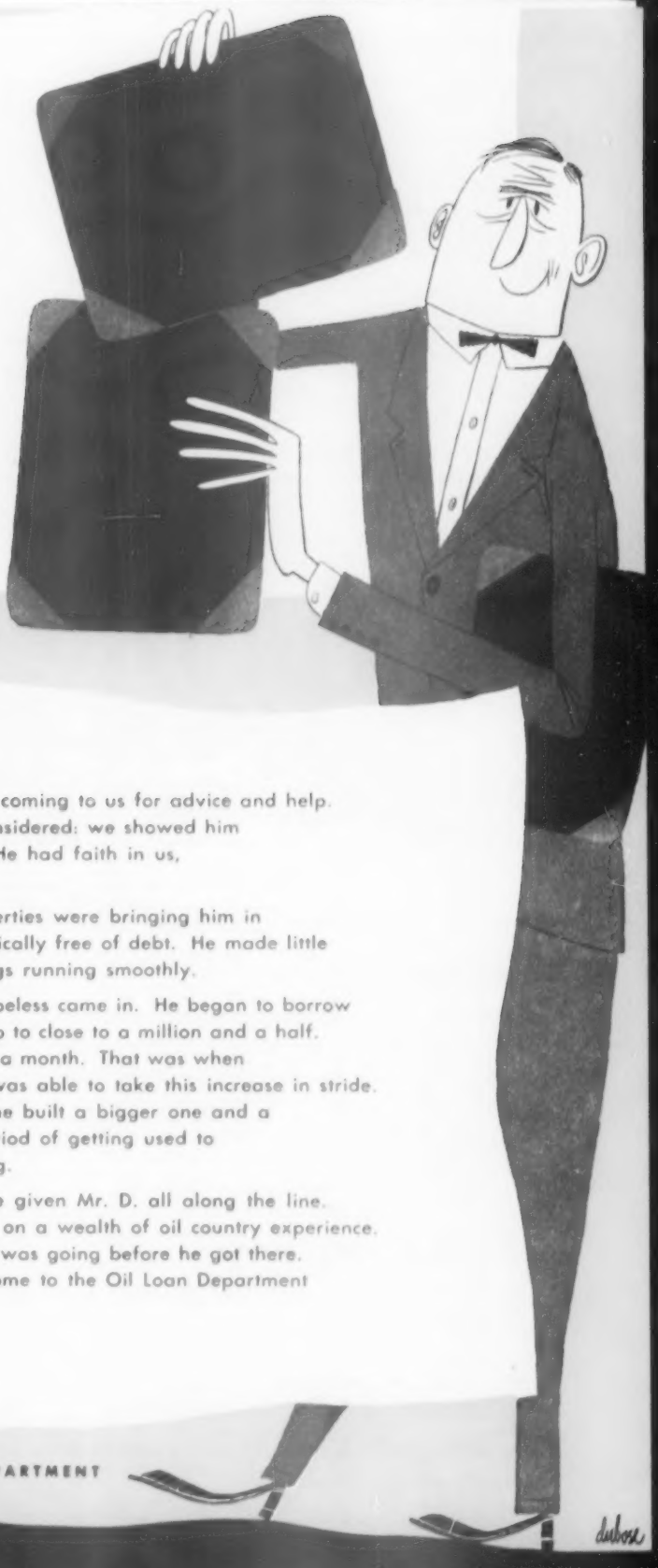
The 'Jeep'®

family of 4-wheel drive vehicles

WILLYS...makers of the world's most useful vehicles

WILLYS MOTORS, INC., TOLEDO 1, OHIO

Mr. "D" came for advice



When Mr. D. first got started he began coming to us for advice and help. We helped him in a way that he had not considered: we showed him the need for building a good organization. He had faith in us, and he did build a good operation.

Mr. D. was doing pretty well. His properties were bringing him in around $25,000 a month, and he was practically free of debt. He made little deals all the time, just enough to keep things running smoothly.

Then a wildcat that was considered hopeless came in. He began to borrow to define his field limits, and his debt ran up to close to a million and a half. But his income jumped to around $100,000 a month. That was when Mr. D.'s organization paid off for him. He was able to take this increase in stride. With the nucleus of a strong organization, he built a bigger one and a strong one. Instead of having a difficult period of getting used to bigger operations, he sailed smoothly along.

We are proud of the help that we have given Mr. D. all along the line. We helped him with impartial advice based on a wealth of oil country experience. We helped him because we knew where he was going before he got there. This sort of help is why oil men **going up** come to the Oil Loan Department of The National Bank of Commerce.

E. O. BUCK, VICE PRESIDENT, OIL LOAN DEPARTMENT

dubose

THE NATIONAL BANK OF COMMERCE
OF HOUSTON

Gulf Building, Houston, Texas "The Bank for All the People"

MEMBER FEDERAL DEPOSIT INSURANCE CORPORATION

Facilities of the Oil Loan Department of The National Bank of Commerce are available in Wyoming, Colorado, Nebraska, New Mexico, Texas, Louisiana, and Mississippi.

It's a GAULIN
with multiple-cylinder gasoline engine! Can be either belt driven or direct connected.

It's a GAULIN
with one-cylinder gasoline engine!

It's a GAULIN
with electric motors integral in unit!

...wherever you see them GAULIN TRIPLEX PUMPS keep on working!

Surface Power Units for Subsurface Hydraulic Pumping

These Gaulin features have been developed especially to meet the requirements of the oil industry.

HORIZONTAL DESIGN

of power unit completely separates cylinder from crankcase, preventing any product leakage to crankcase. Cylinder assembly may be taken apart in minutes. Just lift cover and all parts instantly accessible for inspection or repair.

PLEXIGLAS WELL COVERS

give instant visual check of plunger and packing condition.

CORROSION-PROOF CYLINDERS

are made of stainless. Hardened stainless or ceramic plungers available.

SPRING-LOADED PLUNGER

packing is self-adjusting, self-sealing, eliminates the human element.

API BALL VALVES

and removable seats permit easy replacement in the field.

WIDE CAPACITY AND PRESSURE

range easily, economically obtained by changing plunger size in the field.

MANUFACTURED BY:

Manton-Gaulin Manufacturing Co., Inc.

73 Garden St., Everett 49, Mass.

Gaulin TRADE MARK

***Call:* Specialty Sales & Service, Inc.**

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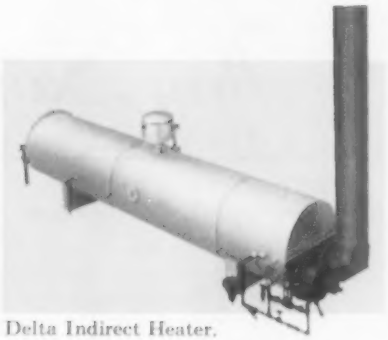
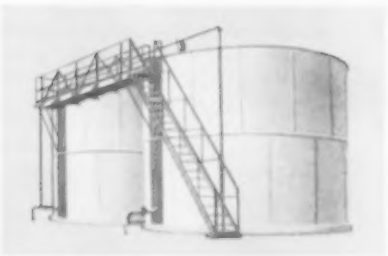
MANTON-GAULIN MANUFACTURING CO., INC., La Habra, California

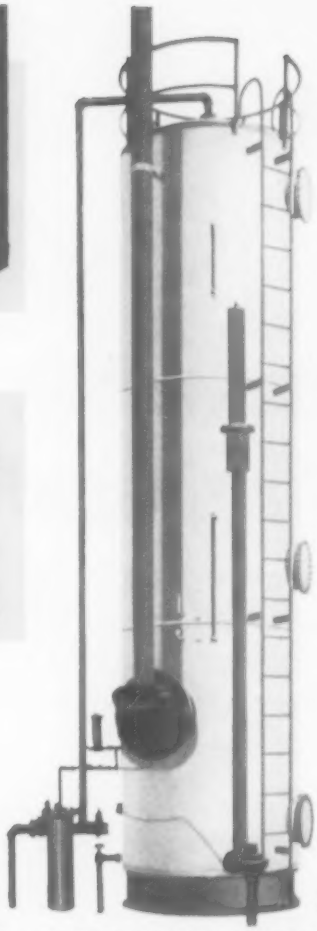
M. Les Walraven, Mgr. Oil Field Sales (Oxford 7-6334) (Long Beach 4-1596)



Delta Indirect Heater.



Delta Bolted Steel Tanks.



Delta Emulsion Treater.

Delta Bulk Storage Bin.

Delta Spherical Separator. *(Patent Pending)*

VERTICAL TREATERS OF PROVEN DESIGN CAN BE OBTAINED CONVENIENTLY FROM DELTA

Gulf area requirements for Emulsion Treaters can be filled promptly from Delta's strategically located warehouses. These treaters are designed to provide maximum heating efficiency, quiet settling and simplicity of installation. The design is the widely used and proven vertical type which facilitates various production problems such as handling of sand and other precipitates. In addition to these standard units, Delta will also build special treaters for specific applications, or to your specifications. Just refer your emulsion treating problem to us.

Delta Treaters are only a part of a line of thoroughly field-tested oil and gas production equipment. Ask the Delta man about bolted and welded steel tanks, heaters, spherical separators, three-phase separators, low temperature extraction units, specially-designed and packaged offshore production units and bulk handling equipment.

The entire line is backed by Delta service from stocking points at Baton Rouge, Louisiana; Westwego and Lafayette, Louisiana.

Delta's Main Plant at Baton Rouge, La.

Write, call or wire for further details.

DELTA TANK MANUFACTURING CO. INC.

111 Bridge City Ave. Westwego, La. | Scott Road Lafayette, La. | Choctaw Dr. Baton Rouge, La.

EXPORT OFFICE: INTERNATIONAL TRADE MART, NEW ORLEANS, LA.

MANUFACTURERS OF PRESSURE VESSELS AND OIL FIELD EQUIPMENT

Oil is Where You Find It!

...and so is Experience!

✳ A completely staffed Oil Loan Dept. to counsel correspondents... 14 Directors affiliated with the Oil Industry... One of the largest Oil Credit files in the U.S.

✳ Introducing

W.L. KENDALL

...a graduate engineer and geologist who turned to Banking at an early age... From the "show-me" State... He can not only talk the "oil" language, he's made up some of the words!

..in TULSA, it's BOTH pleasant AND profitable to

Think...FIRST

FIRST NATIONAL BANK & TRUST CO. of TULSA Member Federal Deposit Insurance Corporation

They Say—

$800 Million Cost Ridiculous

"Predictions that removal of federal price controls from natural-gas producers would cost American consumers $800 million a year are baseless and ridiculous.

". . . Just look at the record: During the 16 years before regulation, gas prices to the household consumer rose only 7 per cent, while the general cost of living rose 90 per cent in the same period.

"Despite these facts, this fantastic figure of $800 million has been adopted as economic gospel by certain groups and individuals who favor leaving gas producers in the strait jackets of government price-fixing, where they were first placed in the summer of 1954. This is the first time in the peacetime history of the United States that competitive industry producing a consumer commodity has been so regulated.

L. F. McCOLLUM

". . . To raise decontrolled prices anywhere near the predicted sum would seriously endanger the natural-gas industry's competitive position with oil and coal, and could well drive gas entirely out of the fuel market.

"Those in favor of federal controls would have the public believe that the field price of gas is a major factor in the household gas bill, that controls are all that is keeping the price down, and that if controls were removed the sky would be the limit as far as producers were concerned.

"But the truth is that the producer's average share of the household gas bill is only about 10 per cent. The other 90 per cent pays for transportation and distribution services.

"The facts are that the more regulation imposed, the higher the prices. Look at the distributor's share. He has always been regulated, and he gets the biggest cut of the gas dollar. Look at the long pipeline owner. He has been regulated since 1938, and gets the next largest cut. Now, look at the producer, who has never been regulated. He gets the smallest cut, usually about 10 per cent."

L. F. McCollum, president of Continental Oil Co. and chairman of Nat-

Give those Joints a "break" with *Jimmie Gray* 500 TON-

NOW IMPROVED

to meet the demands of Faster, Deeper Drilling!

USED EXCLUSIVELY ON WORLD'S DEEPEST WELL IN PLACQUEMINE PARISH, LA.

Most widely used tool joint compound!

Use Jimmie Gray Dope Brushes!

PETROLEUM DISTRIBUTING CO.

P. O. BOX 203
Phone—CAPITOL 4-9648
HOUSTON, TEXAS

Look for the Red Arrows

As drilling demands increase . . . so does the quality of Jimmie Gray Compounds! That's why Jimmie Gray "500 TON" Tool Joint Compound has been fortified with additional additives . . .

- **to further increase anti-weld safety to 27%**
- **to further decrease heat from friction!**

The Improved Jimmie Gray "500 TON" Tool Compound has unsurpassed adhering and adhesive characteristics . . .

- **to further decrease wear as much as 17%**
- **to further withstand increasing temperatures of deeper drilling!**

You can always depend upon Jimmie Gray "500 TON" Tool Joint Compound for quality that keeps ***ahead*** of your needs ***thru constant research!***

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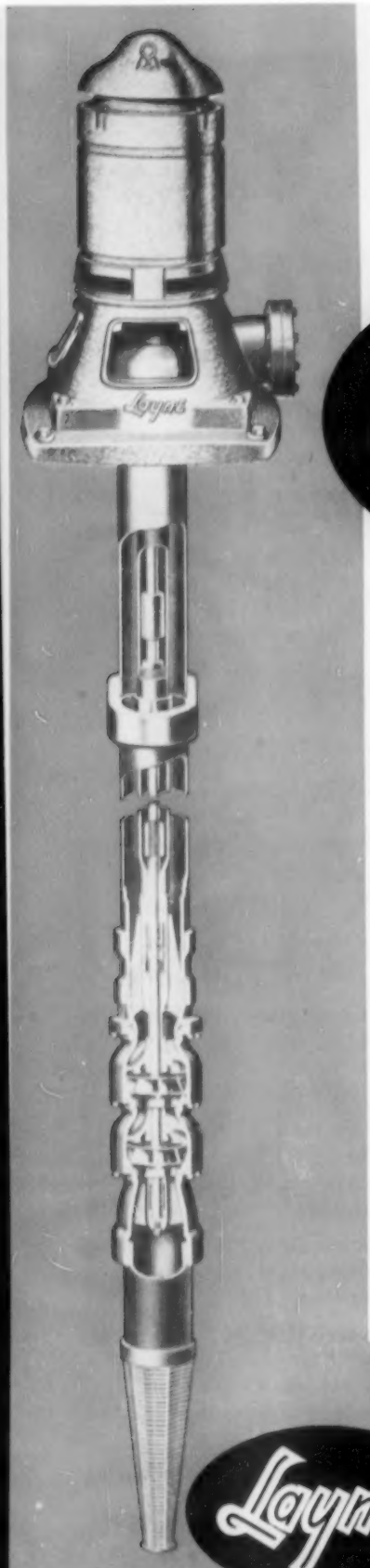

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VERTICAL TURBINE PUMPS

Tested and proved in thousands of installations of all types, the world-wide leadership of Layne pumps has led the field for one overall reason—PERFORMANCE . . . under all kinds of operating conditions.

That envied, but never duplicated, performance record has been made for many reasons. These are a few:

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2. Concentration on one make: A lifetime of experience is behind every Layne pump . . . and that accumulated "know how" is focused on one pump alone.
3. Proven design: The basic design of a Layne pump has been job tested under every conceivable operating condition. And that design is converted into a finished unit through a series of highly specialized and quality-controlled factory operations.

To know all the reasons why Layne pumps are preferred by Industry—Municipalities—and Agriculture, write for bulletin number 100.

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LAYNE ASSOCIATE COMPANIES THROUGHOUT THE WORLD

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ural Gas and Oil Resources Committee, in public statement.

"Mild" vs. "Severe" Engines

Dear Sir:

In the article "Fuel Limits Force Need for Milder Auto Engine," page 54, November 28 issue of The Oil and Gas Journal, there is a statement which is not quite correct and which may lead to a somewhat mistaken concept of the mutual adaptation of motor fuels and automotive engines.

In brief, the statement says that "mild" engines are those with nearly the same octane requirements on the test block as in actual road operation. The correct concept of a "mild" engine is that its own rating of a fuel is nearer that of the CFR Research Method rating, and a "severe" engine is one that rates fuel near the CFR Motor Method.

This comment is not to find fault with the article, which excellently reviews the papers presented at the S.A.E. meeting in Philadelphia last month, but merely to clarify just what the point of the papers really was.

W. F. Ford
Superintendent
Produce Use Laboratory
Continental Oil Co.

More on Platform Design

Dear Sir:

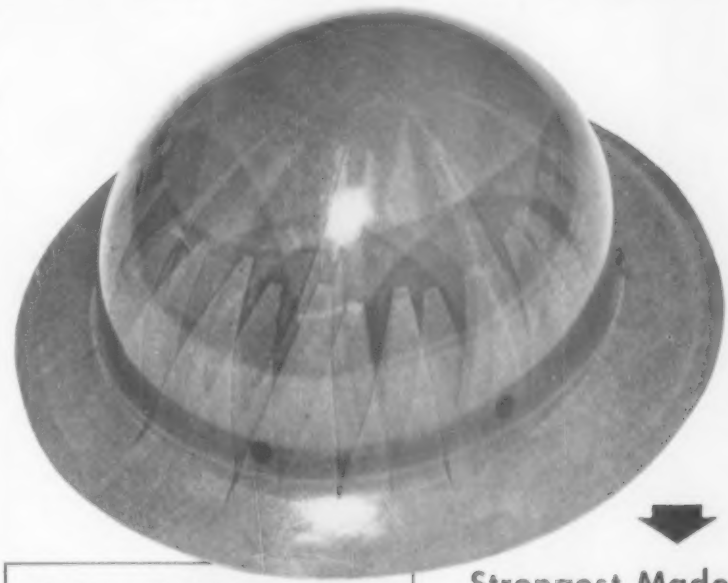
I have just read the article, "Reduced Upkeep on Drilling Platforms Begins With Good Design" which appeared over my name in the December 5 Journal. This was a condensed version of a much longer paper which I presented at the South Central Regional Meeting of NACE in Houston 6 weeks ago.

Let me compliment your rewrite man on a fine job of presentation. His is an onerous and occasionally risky task, because sometimes the writer's original intent is altered by the cutting shears.

In the Journal article, referring to Fig. 1, the statement was made that "Design E will theoretically save $10,000 per well in 20 years of corrosion control." To this should have been added, "compared to Design C, an earlier design by the same company."

Your caption for Fig. 3, "Box-type deck is perhaps the simplest answer to getting rid of some hard-to-coat areas," leads one to believe that a boxed-in deck is a proven solution to the problem. Actually, boxed-in decks have not been used offshore and must be analyzed more fully before they can be recommended. As pointed out in the full text of my paper, "The boxed-in deck would require some design revision,

LOOK TO WILLSON
for another new development in head protection!



NOW—SUPER-TOUGH
PHENOLIC
SAFETY HATS AND CAPS

FROM THE WILLSON RESEARCH CENTER now comes the "Phenolic" line of scientifically designed safety headgear that meets all specifications with ease!

In this Super-Tough line are safety developments so outstanding that you'll find it offers unequalled value. For instance, the famed "geodetic suspension" and the unique pneumatic headband are obtainable in both adjustable *lace-in* and *snap-in* types of hats and caps.

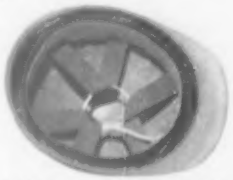
Ask your Willson distributor to demonstrate the heavy duty Phenolic line that combines comfort and maximum head protection. Or write for latest "Super-Tough" bulletin describing them in detail.

Strongest Made!

See how it's built up from 24 individual die cut pieces into a sturdy Phenolic pattern that withstands repeated 80-foot-pound drop ball tests without even fracturing!

LACE-IN SUSPENSION

Both hats and caps are available with convenient lace-in suspension feature. Easily adjusted for snug comfort to any head size.



SNAP-IN SUSPENSION

Handy Center-Tie snap-in type suspension is also obtainable in Super-Tough hats and caps. *Willson's exclusive patented "Geodetic Suspension" and Pneumatic Headband can be had in any style!*

Over 300 safety products carry this world-famous trademark

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You bet... we always rely on United!

Down time? Not any more. We get oil field supplies from United Supply. We take their reliable, fast service for granted now. Yep, they carry nationally known products and always have them on hand. You can sure rely on United Supply.

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and might cost more initially than the timber-topped structural steel deck."

You have quoted me as saying that welded monel sheathing "has the disadvantage of being easily damaged by boats." Personally, I do not feel that this is true. The original text of my paper reads, "Four out of seven companies questioned are using monel on all steel structures, and one may use it on platforms where production is a certainty. The two operators who do not use monel are against it because of susceptibility to boat damage."

D. B. Stauffer
Humble Oil Refining Co.
Houston.

What's Basis for Oil Prices

"Crude prices must reflect the cost of production here — not somewhere else . . . It is well recognized that the American oil industry cannot survive if crude prices are to be determined by production costs in the Middle East. Eighteen-barrel wells cannot compete with 6,000-bbl.-per-day wells, and it is our job to find the means of insulating ourselves against such an arrangement.

"Reports of many major oil companies suggest the industry is quite prosperous . . . This is a case of beauty being only skin deep. An objective analysis of industry earnings would show that the brightest picture appears on the part of those companies with foreign holdings.

"When profits from foreign holdings are separated on the stockholders' reports of these big companies, it can be seen that domestic enterprises aren't fairing nearly so well and certainly no more so than other comparable industries.

"Whatever the over-all financial picture of oil companies, if crude prices are inadequate to provide a reasonable return to the exploration and producing end of the business, the industry is in jeopardy and the profits picture is an artificial one."

A. P. King, Jr., president of Texas Independent Producers and Royalty Owners Association, in December issue of TIPRO publication.

CALENDAR

1956

JANUARY

16-18 Pipe Line Contractors Association, eighth annual convention, Boca Raton Hotel and Club, Boca Raton, Fla.

25-26 Northwest Petroleum Association, annual convention, Nicollet Hotel, Minneapolis.

25-27 Eleventh annual Symposium on Instrumentation for the Process Industries, Memorial Student Center, A. & M. College of Texas, College Station, Tex.

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greatly increase resilience of the Rib-Top V-Belt ...enable it to absorb extremely severe pulsations of a mud pump...easily handle peak loads.

Extra resilience helps reduce vibration...practically eliminates belt whip.

2. Stabilizing ribbed top (U.S. Pat. No. 2548135)

found in no other V-belt...dampens vibration AND protects top of belt against damage. On idler-equipped mud pump drives, ribs keep belt running smoothly over idler, with no side slip.

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provide sure pulling power, longer wear—for this interesting reason:—When you bend the belt around the sheave the sides fill out and become straight, thus fitting the pulley evenly (Fig. 1).

(Straight-sided belts *bulge* at the sides when bent. Uneven contact (Fig. 2) causes uneven wear, shortens belt life).

4. Flex-weave cover (U.S. Pat. No. 2519590)

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Gates Rib-Top V-Belts are available from your Oil Field Supply House *for the same price you pay for ordinary belts.* The Gates Rubber Co., Denver, Colorado—*World's Largest Maker of V-Belts.*

TPA 39

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GATES RIB-TOP VULCO ROPE

The only V-belt in the world developed especially for mud pump drives

26-27 Fifth Annual Instrument Short Course, Los Angeles Harbor Junior College, Wilmington, Calif.

FEBRUARY

15-17 National Association of Corrosion Engineers Short Course for Pipeliners, Mayo Hotel, Tulsa.

19-23 American Institute of Mining and Metallurgical Engineers, annual meeting, Hotel Statler, New York City.

24 Natural Gasoline Association of America, Permian Basin meeting, Lincoln Hotel, Odessa, Tex.

26-29 American Institute of Chemical Engineers, Statler Hotel, Los Angeles.

27-29 American Association of Petroleum Geologists, Rocky Mountain Section, Auditorium, Denver.

MARCH

1-2 Southern Gas Association, transmission management conference, Jung Hotel, New Orleans.

7-9 American Petroleum Institute, Division of Production, Southern District meeting, Plaza Hotel, San Antonio, Tex.

12-16 National Association of Corrosion Engineers, annual convention, Statler Hotel, New York City.

19-21 Western Petroleum Refiners Association, annual meeting, Plaza Hotel, San Antonio, Tex.

21-23 American Petroleum Institute, Division of Production, Southwestern District meeting, Texas Hotel, Fort Worth.

24 North Texas Oil and Gas Association, annual meeting, Wichita Falls, Tex.

APRIL

3-5 Annual Corrosion Control short course, University of Oklahoma Extension Study Center, Norman, Okla.

4-6 American Gas Association, general management conference, Conrad Hilton Hotel, Chicago.

4-6 American Petroleum Institute, Division of Production, Mid-Continent District meeting, Broadview Hotel, Wichita, Kans.

8-13 American Chemical Society, general meeting, Dallas.

9-10 Texas Petroleum Research Committee, Ninth Oil Recovery Conference (Symposium on Natural Gas in Texas), Texas A. & M. College, College Station, Tex.

11-13 Natural Gasoline Association of America, Texas Hotel, Fort Worth.

14-15 Southern Gas Association, conference on use of electronic computers by engineering personnel, Hilton Hotel, El Paso.

14-18 Petroleum Equipment Suppliers Association, annual meeting, Boca Raton Hotel & Club, Boca Raton, Fla.

15-17 Texas Independent Producers and Royalty Owners Association, Statler Hilton Hotel, Dallas.

17-19 Southwestern Gas Measurement Short Course, University of Oklahoma, Norman, Okla.

18-20 American Petroleum Institute, Division of Production, Rocky Mountain District meeting, Cosmopolitan Hotel, Denver.

18-20 National Petroleum Association, semiannual meeting, Cleveland Hotel, Cleveland, Ohio.

19-21 Gas Appliances Manufacturers Association, annual meeting, The Greenbriar Hotel, White Sulphur Springs, W. Va.

23-25 Southern Gas Association convention, Dallas.

23-26 American Association of Petroleum Geologists and Society of Economic Paleontologists, annual meeting, Conrad Hilton Hotel, Chicago.

25-27 American Petroleum Institute, Division of Production, Eastern District meeting, Deshler-Hilton Hotel, Columbus, Ohio.

25-29 World Oil Exposition, Houston.

30

May 1 Independent Petroleum Association of America, semiannual meeting, Statler Hotel, Los Angeles.

30

May 4 American Petroleum Institute, Safety and Fire Prevention midyear meeting, Warwick Hotel, Philadelphia.

MAY

6-9 American Institute of Chemical Engineers, Roosevelt Hotel, New Orleans.

10-11 American Petroleum Institute, Division of Production, Pacific Coast district meeting, Statler Hotel, Los Angeles.

10-11 American Gas Association, Gas Supply, Transmission, and Storage Conference, Conrad Hilton Hotel, Chicago.

14-17 American Petroleum Institute, Division of Refining, midyear meeting, Montreal.

16-18 American Gas Association, Chemical, Engineering, and Manufactured Gas Production Conference, Benjamin Franklin Hotel, Philadelphia.

24-25 Natural Gas and Petroleum Association of Canada, Sheraton Brock Hotel, Niagara Falls, Ont.

JUNE

17-22 American Society for Testing Materials, annual meeting, Chalfonte-Haddon Atlantic City, N. J.

24-25 Canadian Gas Association, Manoir Richelieu, Murray Bay, Que.

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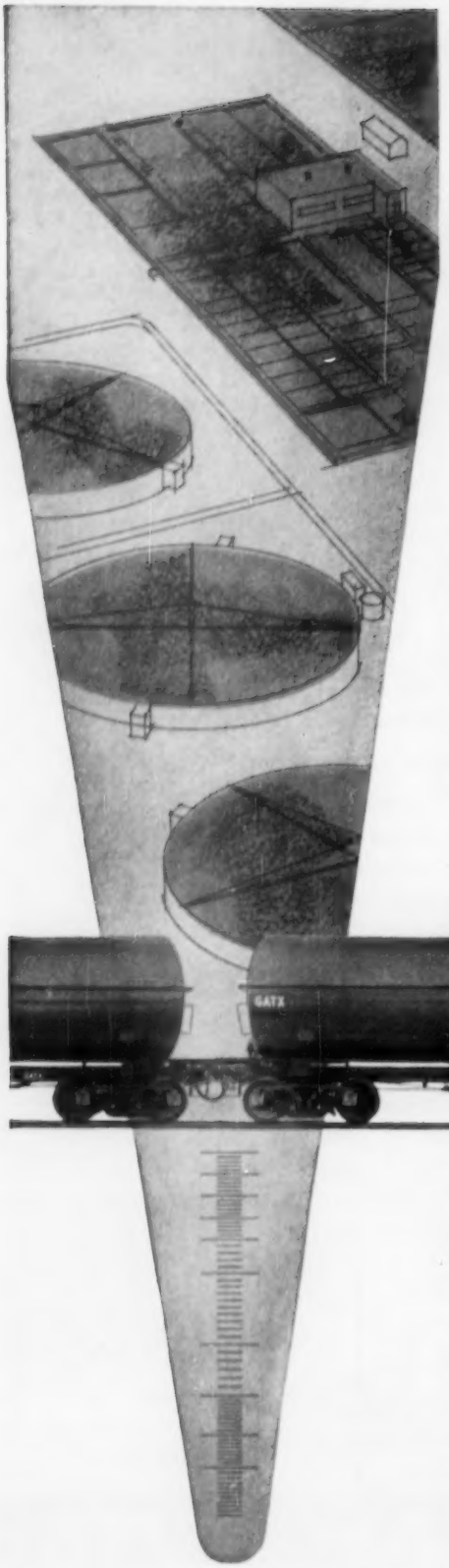

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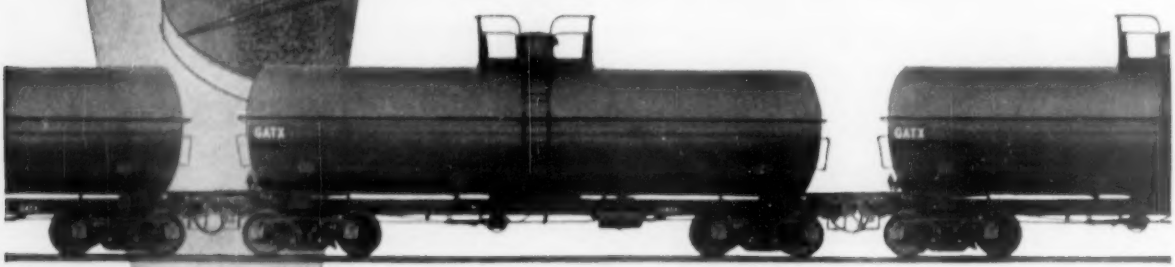

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TULSA, OKLAHOMA

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JOURNALLY SPEAKING . . .

Revenge Is Sweet

THAT old Pittsburgh pipeliner, A. T. Bennett, whose reminiscences have brightened this department previously, sends us a Christmas present in the form of one of his best stories to date.

"Several years ago while buying right-of-way in West Central Pennsylvania," he writes, "I had occasion to approach a farmer for right-of-way. He was a man of about 70 years of age, and, while he lived on a farm, didn't appear to be doing much farming. He mostly wanted to talk.

"When I presented the right-of-way agreement, he had several changes that he wanted to have made. Not wanting to agree to them on my own, I presented them to my superior who revised the form. In a day or two I took the revised form to the farmer, who again looked it over and asked for additional changes.

"I again went through the above procedure, and again took the agreement to him. He asked that I leave the agreement and stop back later, which I did. He asked for one more change, which I had done for him, and he signed the right-of-way agreement with no more trouble.

"After the signing, I told him that so many changes had been made that the agreement was back in the original form, and asked him how come?

"'Well,' he said, 'I'm an old right-of-way man myself, and used to work for Bell Telephone. I've been waiting for a chance to be on the other side of the fence so I could be just as stubborn, independent, and crazy as some of the people I've had to deal with for right-of-way.'"

Chew On This

HERE'S a bit of intelligence that ought to (but probably won't) give pause to those eastern consumers and distributors of natural gas who poohpooh the idea that federal control will cut down their supply. It's an answer to their question: "What else can producers do with their gas except sell it to interstate pipelines?—they can't eat it."

But they can eat it—indirectly.

Natural gas is the No. 1 material for making nitrogenous fertilizers. Fertilizers produce food crops and meat for human consumption. A favorite form is urea, which also contains protein of a type easily assimilated by cattle and sheep. One pound of urea contains as much protein as 6 lb. of soybean meal. Factories to make urea from natural gas have been expanding rapidly and now have a capacity of half a million tons per year. About half the output goes into fertilizer and about a quarter directly into animal feed. The rest goes into plastics.

So, you see, you can eat natural gas. And if producers don't like the price FPC sets for their sales to interstate transmission companies they will be delighted to sell to a urea or other petrochemical plant in their state and thus escape federal regulation completely.

And don't think that the petrochemical people aren't aware of this. If the Harris bill fails to pass there will be an even greater rush to build plants using gas as a raw material right down near the producing fields.

For Tricycles, Maybe?

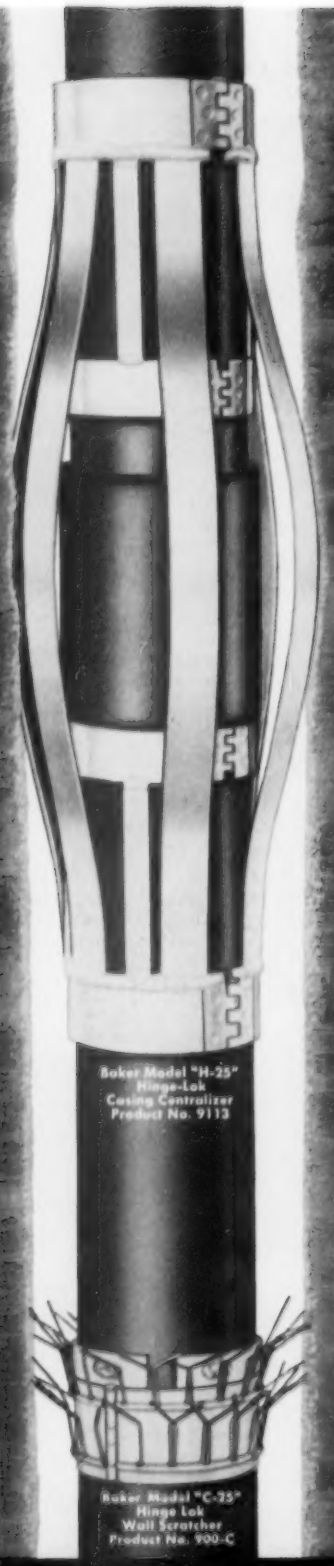
EVER hear of a three-cycle engine? You will if you turn back to the December 19 Journal and read page 108. Our printers invented one, as several of our eagle-eyed readers have pointed out.

What's more, they stuck the announcement of this three-cycle wonder right in the middle of a perfectly serious article on two-cycle engines written by R. L. Boyer, chief engineer of Cooper-Bessemer Corp. We hasten to explain that Mr. Boyer, while an expert on the idiosyncrasies of two-cycle and four-cycle engines, has never tried to crossbreed them to produce a three-cycle engine.

To set the record straight, that sentence at the bottom of the middle column should read: ". . . the two-cycle engine would not perform well at low speed because its lubricating-oil pressure reduced too much."

One of our readers asked us to explain how a three-cycle engine operates. But we can't even explain how a reference to such a mechanical wonder got into the book. Neither can our proofreader.

—*Henry D. Ralph.*



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Outstanding Combination

for BETTER primary cementing...

. . . BAKER CASING CENTRALIZERS to provide clearance for a uniform body of cement around the casing—and BAKER WALL SCRATCHERS to scratch away the mud cake and expose the formation for better bonding of the cement.

EFFECTIVE CENTERING

BAKER CASING CENTRALIZERS have a balanced combination of proper spring *length*, and proper *bowed height* to provide EFFECTIVE CENTERING FORCE over the entire area to be cemented. And each spring is pre-tested and pre-set to ensure having this Vital Centering Force *at the cementing point* regardless of depth or hole deviations.

CONTROLLED SCRATCHING

BAKER WALL SCRATCHERS perform a "Controlled" scratching job because the wires remain close against the casing while running in the hole and *do not damage the vital filter cake* on the way down the hole. Only when the actual "wall scratching operation" is commenced, do the overlapping wires (mounted in a strong DOUBLE shell) go to work scratching away the mud sheath and exposing the formation for *far better bonding* of the cement.

AVAILABLE IN EXACT TYPE AND SIZE REQUIRED

Baker Casing Centralizers are available in either the hinged (Model "H" HINGE-LOK, Product No. 9113, illustrated) or slip-on (Model "G", Product No. 910-G) models, each with a complete range of spring-bowed heights for each casing OD—one exactly right for most casing clearance programs. Baker Model "C" Wall Scratchers are also available in either the hinged (Model "C" HINGE-LOK, Product No. 900-C, illustrated) or slip-on (Model "C" Solid Ring, Product No. 901-C) models with your choice of 2½-inch (C-25) or 4½-inch (C-45) scratcher wires. Ask your Baker Representative about this *outstanding combination* for better primary cementing.

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BAKER

WALL SCRATCHERS
CASING CENTRALIZERS

Extra work on the gas bill now will pay off

THIS is the eleventh hour for the Harris-Fulbright bill. Within the next 2 months the Senate will decide whether gas producers are to remain public utilities or be freed from the more obnoxious and unworkable aspects of federal control.

In some quarters there has been a feeling that it is now too late to do much except hope, pray, and wait for the vote—that the die is cast, all minds are made up, and that further talk would accomplish little at this late date.

On the contrary, now is the time for the entire producing industry to increase its effort to gain support for the bill. It's not too late to do some good, because:

PRESENT INDICATIONS ARE that the vote in the Senate may be even closer than the six-vote margin by which the bill passed the House. Quite a few senators are not publicly committed on the bill and could be swayed for or against it by thoughtful argument or by appeals from their constituents.

The issue is now much clearer than a year ago when Congress first began consideration of the problem. This makes it easier to explain. It can no longer be described as a fight between a few hundred producers and several million consumers, for the bill has been amended to include many restrictions on producers and many safeguards for consumers.

The issues are now boiled down to these two: (1) the general principle of federal interference in a local activity; and (2) whether more gas will be available at reasonable prices by regulating producers under rules designed for a public utility or by the more flexible plan of the Harris bill.

Furthermore, the opposition has now congealed into two groups: (1) professional liberals, congenital opponents of business, and advocates of federal control of practically everything; and (2) local gas distributors (and some pipelines), themselves utilities, that hope to gain individual business advantage by imposing control on their suppliers.

A CLEAR EXPLANATION of the facts about the Harris bill as they exist today could dispel the confusion and misunderstandings still existing in the minds of the senators and voters of many states.

The associations and committees that speak officially for oil and gas producers have improved their techniques for making friends and influencing people on this gas matter. But they need every bit of help they can get from individual producers and all friends of states' rights and business freedom.

The next 60 days are vital to the oil and gas industry. Instead of a letdown, let's have a final sprint for the finish line.

ROUND TRIP SQUEEZE TOOL
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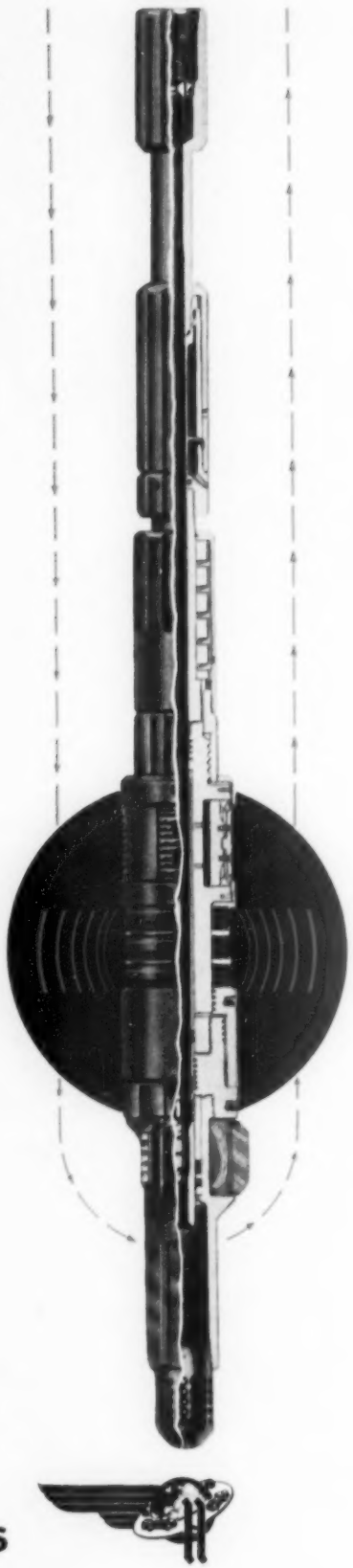

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The Industry This Week

Processing

• **Refiners won't be able to rest on their octane laurels.** Requirements just figured for 1956 automobiles show that gasoline in some areas won't keep the knock out of new high-compression engines. And the pressure will be on everybody to raise octanes to keep pace with '57 models. P. 58.

A super research tool for refiners is announced by Gulf Oil Corp. It is gas-liquid partition chromatography. The process quickly splits gases and liquids which the most elaborate distilling columns either could not take apart or would require weeks to do. P. 61.

Exploration

• **Average footage cost for drilling last year** was $4.90—the biggest bargain since 1949. The Association of Oilwell Drilling Contractors says higher costs of tubing, casing, and other equipment, however, raised average total cost of drilling and completing a well to $13.50 per foot. P. 66.

Stanolind may start this month on a $2 million search for oil in Jamaica. A deal to take over Base Metals' exclusive concession is being completed. The Toronto firm sold out to Stanolind after drilling a promising wildcat last summer. P. 74.

Texota Oil Co. has found oil in a rank wildcat near North Dakota's Canadian border. The likely producing sand is the Upper Mission Canyon from 6,206 to 6,241 ft. P. 63.

East Texas oil operators are watching with interest a prospective new Paluxy sand pool in Titus County. It apparently lies on the Sulphur River fault paralleling the Talco fault to the south. P. 69.

Regulation

• **Richfield is putting state oil conservation** up to California voters. The state has no law regulating oil and gas production. The people have rejected two previous regulatory proposals. But now Richfield is taking a new tack in an initiative petition. P. 65.

Texas has started another experiment feeling its way toward ratable take of natural gas. The new guinea pig is prolific Waskom field in East Texas. Experience with proration rules in Waskom may furnish a guide for statewide regulations to assure all producers a fair share of the market. P. 62.

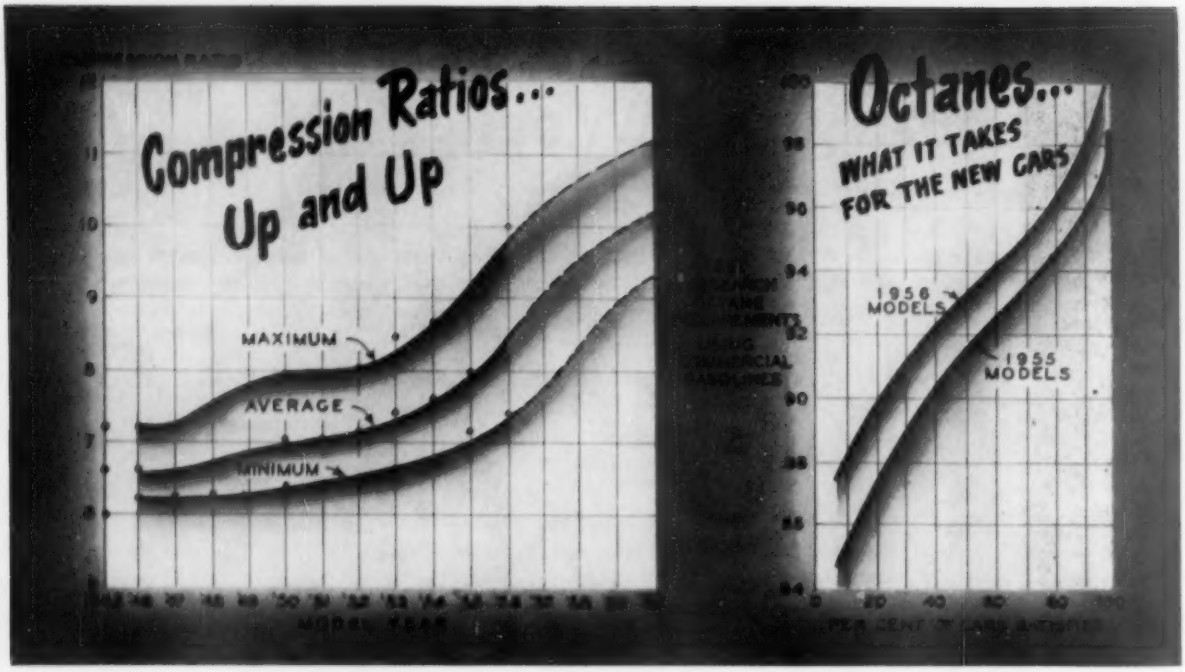
Railroad Commissioner Olin Culberson has come up with still another plan. He thinks gas production can be prorated according to individual pipeline demands. P. 63.

Industry

• **Houston Oil Co. directors have aprpoved liquidation** of the company. Plan calls for sale of all oil and gas properties and Houston Pipe Line Co. to Atlantic Refining Co. It is contingent upon approval of stockholders, expected within 60 days, and sale of paper and timber subsidiaries.

Under the plan, Houston would receive $165 a share, or a total of $224,654,265. In recent months the stock had been below $150.

Sale of oil and gas properties would give Atlantic Refining 17,000 bbl. daily more crude and condensate production. It now refines about twice the amount of its own crude production.



New Models Put the Heat on Refiners

- Octane cushion built up last year will be enough to keep the knock out of most new cars
- But some refiners face trouble now, and all will be under pressure to meet 1957 needs

George Weber

NEW YORK. — U. S. refiners are once again under the gun on octanes.

They upped antiknock quality across the board during 1955, and wound up the year with some octane cushion so far as the 1955 car requirements were concerned.

But the slack is being taken up with the 1956 models, and it will hurt in some localities. Detroit duly noted the upward octane trend last year, and followed its policy of moving compression ratios higher.

Here's what the 1956 models offer:

. . . **Compression ratios** ranging from 7.47/1 to 10/1, averaging 8.4

. . . **Horsepower ratings** from 101 to 305, averaging 200.

. . . **Octane requirements** probably up 1½ to 2 research numbers.

The increase in weighted average compression ratios for 1956 is expected to equal if not exceed the jump made in the 1955 cars a year ago.

This does not mean, however, that octane requirements will rise proportionately. In fact it appears at this time, on the average, the new cars will place less pressure on octanes than did the 1955 models.

This is explained by the fact that as octanes and compression ratios move upward, gasoline antiknock quality required to satisfy a fixed increment in compression-ratio increase becomes less.

The net beneficiary of this relationship is not the refiner but the motorist. The pressure remains on octane improvement, but as the industry moves higher on the scale each octane will produce successively more engine power. Aside from this growing dividend, the octane race is still the same old story. Refiners will hear complaints from some new car owners in some areas, and the pressure from Detroit will continue firm.

Where refiners stand . . . Much has been said about the octane cushion which refiners built up last year by increasing antiknock quality at a record pace.

This cushion is hard to pin down since it varies geographically. In some areas which enjoyed a full two research-number spread between gasoline quality and what might be termed average car needs, there should be little pressure from new car owners. But other refiners marketing in the lower-octane regions with a cushion of one octane or less may look for trouble.

The weighted national average octane number of premium grade in this country now stands at 96.1 research.

This average will satisfy roughly 90 per cent of all of the 1955 cars now on the highways. But this average fuel will operate without knocking in but 80 per cent of the new 1956 models.

It will probably take from 1½ to 2 more research octane numbers to satisfy 1956 models than it took for last year's cars. By comparison, the 1955 models required an octane jump of 2 to 2½ or more numbers.

Weighted average compression ratios in the 1955 models stood at 7.92, taking into consideration the volume of production of the models in the various compression-ratio levels. Estimates of 1956 car production indicate that the weighted average for this year may reach about 8.4 compression ratio.

But to both the refiner and the car designer, these national averages are primarily of academic interest. It is of small consolation to the refiner who is pressed to meet new octane needs to know that on the average the industry

is keeping well abreast of the over-all trend.

Car makers, too, must look beyond the averages. They are limited in how far they can go by the lowest available octanes, not by the average, since their cars are shipped with roughly the same octane requirements to all parts of the country.

What new-car figures mean . . . What good are these average figures on octane and car requirements?

Duly defined, they can be valuable to the manufacturing and sales departments of oil companies as a reference point in determining their own position in the continuing quality race.

Consider octane ratings of commercial motor fuels. Ethyl Corp.'s latest national survey in December shows a weighted national average of 96.1 research octane number for premium grade and 88.9 for regular. These figures weight the arithmetical averages for 53 different marketing areas with their respective gallonage.

Each average figure represents a wide variation in quality; from 91.4 to 97.5 research octane for premium, and from 82.5 to 91.6 for regular. Regular gasoline in Pittsburgh averages higher in octane than premium grades marketed in Denver. The spread for individual brands in the city averages is even greater.

Hence, with exception of those cars with definitely high or low octane requirements, it is impossible to generalize on whether a large number of middle-ground models will require premium or house-brand gasoline. With due regard to the effect of altitude, many cars which are satisfied with regular grade in the high-octane regions will require premium elsewhere in the country.

In looking at average car requirements on octane, the problem is much more complex. Since individual cars of the same make and model show wide variations in their octane needs, their requirements are best shown by the octanes which will satisfy 50, 80, 90, and 95 per cent of all cars of that specific model. If an average requirement is quoted, it usually represents the 50 per cent point.

How to figure needs . . . An enormous road-testing program conducted continuously by refiners, car makers, and tetraethyl lead manufacturers will eventually contribute enough information to arrive at a coordinated appraisal of the octane requirements of any year's models.

The 1955 curve shown in the octane chart represents a sound picture of last years' cars. By next autumn, another curve representing 1956 require-

How '56 Cars Compare With '55 Models

	Piston displacement (cu. in.)		Compression ratio-1		Maximum h.-hp.	
	1955	1956	1955	1956	1955	1956
Buick						
8 40 Special Synchromesh	264	322	7.5	7.6	(*)	(*)
8 40 Special Dynaflow	264	322	8.4	8.9	188	220
8 50 Super, 60 Century, 70 Roadmaster	322	322	9.0	9.5	236	255
Cadillac						
8	331	365	9.0	9.75	250	285
8 El Dorado	331	365	9.0	9.75	270	305
Chevrolet						
6 Bel-Air Synchromesh	235.5	235.5	7.5	8.0	123	140
6 Bel-Air Powerglide	235.5	235.5	7.5	8.0	136	140
8 V-8	265	265	8.0	8.0	162	170
8 V-8 Power Package	265	265	8.0	9.25	185	205
Chrysler						
8 Windsor	301	331	8.0	8.5	188	225
8 New Yorker	331	354	8.5	9.0	250	280
Continental						
8		368		9.0		(*)
DeSoto						
8 Firedome	291	330	7.5	8.5	185	230
8 Fireflite	291	330	7.5	8.5	220	255
Dodge						
6 Coronet	230	230	7.4	7.6	123	131
8 Coronet	270	270	7.6	8.0	175	189
8 Custom Royal	270	315	7.6	8.0	183	218
8 Custom Royal Power Package		315		8.0		230
8 Sports		315		9.25		260
Ford						
6 Standard transmission	223	223	7.5	8.0	120	137
8 Standard transmission	272	272	7.6	8.0	162	173
8 Fordomatic Power Package	272	272	8.5	8.4	182	176
8 Thunderbird engine, standard trans.		292		8.0		200
8 Thunderbird engine, Fordomatic		292		8.4		202
Ford Thunderbird						
8 Standard transmission	292	292	8.1	8.4	193	202
8 Overdrive	292	312	8.1	8.4	193	215
8 Fordomatic	292	312	8.5	9.0	198	225
Hudson						
6 Wasp	202	202	7.5	7.5	104	130
6 Hornet	308	308	7.5	7.5	160	175
8 Hornet	320	308	7.8	8.0	208	220
Imperial						
8	331	354	8.5	9.0	250	280
Lincoln						
8 Custom, Capri and Premier	341	385	8.5	9.0	225	285
Mercury						
8 Custom and Monterey	292	312	7.6	8.0	188	210
8 Montclair	292	312	8.5	9.0	198	225
Nash						
4 Metropolitan	73.2	(†)	7.2	(†)	42	(†)
6 Rambler	195.6	195.6	7.3	7.47	90	120
6 Statesman	195.6	195.6	7.45	7.47	100	130
6 Ambassador	252.6	252.6	7.6	7.6	130	145
8 Ambassador	320	352	7.8	9.55	208	220
Oldsmobile						
8 88	324.3	324.3	8.5	9.25	185	240
8 Super 88 and 98	324.3	324.3	8.5	9.25	202	240
Packard						
8 Clipper Deluxe and Super	320	352	8.25	9.5	225	240
8 Clipper Custom	352	350	8.5	9.5	245	275
8 Caribbean and Patrician	352	374	9.1	10.0	275	290
Plymouth						
6	230	230	7.4	7.6	117	125
6 Power Package		230		7.6		131
8	241	270	7.6	8.0	157	180
8 Power Package	260	277	7.6	8.0	177	200
Pontiac						
8 Chieftain and Star Chief	287.2	316.6	8.0	8.9	180	227
Studebaker						
6 Champion	185.6	185.6	7.5	7.8	101	101
8 Commander	224.3	259.2	7.5	7.8	140	185
8 President	259.1	289	7.5	7.8	175	210
8 Golden Hawk		352		9.5		275

*Not reported. †Not yet announced.

ments will be available. But at this time it is possible to estimate these requirements from the information gained by early road-testing of clean 1956 engines.

Such an estimate is represented in the 1956 curve in the same figure. It was derived basically from tests for trace knock on a level road, driving new 1956 cars. These clean-engine requirements must be translated into the higher needs of equilibrium engines. This is done by adding the estimated octane-requirement increase experienced as carbon deposits build up to the point at which they flake off at an equal rate.

Effects of engine design on octane requirements must also be considered. Finally, results obtained using primary reference fuels must be converted to requirements in terms of commercial gasolines.

Such studies, by highly qualified sources, have resulted in the preliminary curve representing the probable requirements of the new models. These curves on requirements relate to the 1955 and 1956 car models whose pertinent specifications are outlined in the accompanying table.

The estimated increase of about 0.48 in weighted average compression ratio reflects a widespread upward move on the part of nearly all models this year. Of particular interst is the big Packard which jumped out ahead of the parade with a 10 to 1 ratio. Close behind is the Cadillac with 9.75, while various models of the Buick, Nash, and Studebaker are in the 9.5 to 1 range.

The spread in compression ratios continues about the same as last year. As plotted, the weighted average compression ratio remains slightly below the middle of the range, which extends from 7.4/1 to 10/1 this year.

New car requirements . . . While it is still too early to get a broad picture of what individual models are going to require, road tests to date give some indications.

A very high requirement is probable for the 10/1 Packard which has shown 100 research-octane requirements on limited models with clean engines. This can be reduced to about 96 by retarding spark from 10 to 5 degrees BTC.

The Buick Roadmaster, Lincoln, Mercury Montclair, and the Oldsmobile also show indications of being high-requirement cars, with equilibrium-engine needs in the 95-octane range or higher. Cadillac, with the second-highest compression ratio, is also a high-requirement car this year, but many models may be satisfied with 95 or lower octane fuels.

Also in the probable 90 to 95 research-octane class are the Chevrolet with power package; Chryslers, including Imperial, DeSoto Fireflite; practically all of the Fords, the smaller Mercury and Nash models; and the Pontiac.

About the only models which will remain essentially below the 90 research-octane range are the 8/1 Chevrolets, the DeSoto Firedome, the Dodge line, the Plymouths, and possibly the Hudsons.

Horsepower soars higher . . . Whether the new-car owner wants it or not, he is sporting a great deal more power under his hood.

Sales managers in Detroit maintain that power is selling cars today, so we can look forward to cars with advertised maximum brake horsepower of 400 or more within the next few years.

For 1956 models, the weighted average horsepower stands right at 200 compared with about 170 for last year's cars. Cadillac sits atop the heap with 305 in the El Dorado model. Close behind and pushing 300 are the other Cadillacs, the Chrysler New Yorker and Imperial, the Lincoln, the big Packard, and the new Studebaker Golden Hawk.

A mass upward surge in power took place in the middle categories, with 13 different models moving past 200 this year. Altogether, over 30 models boast 200 hp. or greater. As is rather cynically stated in automotive circles, these are "advertised" horsepower ratings. Only the new Lincoln Continental and the small Buick Special refrain from naming horsepower ratings.

Octanes of tomorrow . . . It is difficult enough to pinpoint the needs of the current crop of cars without going further.

However, some observers with authority have proved willing to predict what may come to pass in 1957 and even 1960. Compression ratios, they think, will hit a maximum of 11/1 by 1960 at which time the average will be roughly 10/1. The weighted average for next year's models is believed to be about 9/1.

By next year, the refiner will face a need for more than 98 research octane to satisfy 90 per cent of the 1957 models. The high-requirement models will have to have close to 99 octane to obtain 90 per cent satisfaction. This projection agrees with the fairly common expectation that 1957 will usher in 100 octane premium grades.

For the next year or two, actual octanes will probably rise on the average a little over one research number per year. This will show average premium-grade ratings at mid-year of about 96.5 for 1956 and 97.5 for 1957. House brand will gradually close the gap on premium, particularly in the Mid-Continent, Central, and West Coast regions. This is expected to result in weighted national averages of over 90 research for this year and 91 for next year.

Rough estimates of 1960 indicate that while the octane trend will have slowed appreciably, premium will average close to 99 research-octane number, and regular grade about 93. By that time, both the geographical spread on octanes within grades and the overall spread between premium and house brand will have shrunk.

Whatever the accuracy of these long-range forecasts, refiners will have their work cut out for them. Many will find more immediate problems in the requirements of the current crop of cars. But on the whole the industry is fairly well prepared to cope with 1956.

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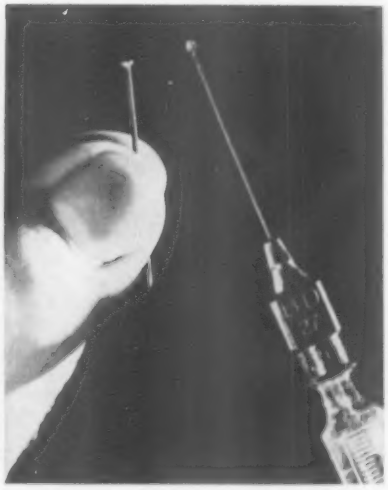


CHARGE STOCK is fed by hypodermic needle, magnified here along side a pin. The tiny charge may contain as many as 15 compounds. They can be accurately separated and measured. The result is a fine, new precision tool for researchers.

In Gulf's super research tool . . .

. . . Hydrocarbons Sliced Thinner

PITTSBURGH.—A more precise way to slice apart the hydrocarbon components of petroleum has been found by researchers for Gulf Oil Corp.

The simple new method has the complicated name of gas-liquid partition chromatography. Gulf scientists say it can "out-distill" the most modern research stills.

Two factors give the process tremendous advantages:

. . . **Precision.** It quickly separates gases and liquids whose boiling points are nearly identical.

Previously the most elaborate present day distilling columns either could not take them apart at all or required weeks to do so.

. . . **Economy.** The process separates materials in quantities too small for distillation.

This permits analysis where only traces are available. It also conserves costly research materials. In fact, a hypodermic needle is used to feed the samples.

What it means . . . Gulf observers report their process opens the door to more exact knowledge of materials.

This knowledge is needed for producing higher efficiency oils, gasolines, chemicals and plastics in the future. Further progress in these fields requires analysis of compounds to increasingly finer degrees, they say.

How it works . . . The apparatus used is simply a long, thin tube.

It is called a chromatographic tube and is filled with a granular powder. Laboratory technicians coat this powdered catalyst with an oily substance. The tube is maintained at a constant temperature ranging up to 300° F.

The fluid to be studied is injected by a hypodermic needle. Part of the fluid goes into solution with the oily matter on the grains of powder. The remainder becomes a gas in the spaces between the grains.

An inert "carrier gas" next is introduced. It forces the gas in the spaces to move forward. More material comes out of solution into the voids between the grains. It in turn is moved forward by "carrier gas."

The process goes on continuously while the flow of "carrier gas" is maintained. It results in different components of the material under study moving down the tube at different rates. Each displays a different equilibrium between its soluble phase in the oil material and its gaseous phase in spaces between grains.

As each component emerges from the end of the tube, it is detected by a thermal conductivity cell.

Value of the process is that compounds in a mixture can be forced forward in a tube at different speeds and can be easily separated at the end.

English discovery . . . The Gulf process is based on phenomenon in physical chemistry recently introduced to practical use by British scientists.

Gulf scientists in 1954 started research to apply it to the analysis of industrial petroleum and chemical materials. By breaking through the limits of distillation, the new technique is described as one of the most basic advances in separating fluids since man learned to boil off alcohol. It is to the distillation column what that column was to the primitive still.

Gulf plans to make the new method generally available for laboratory research. It has arranged with Fisher Scientific Co., Pittsburgh, to make the unit commercially.

Leasing Defended

Interior Department says refuges will be protected

WASHINGTON.—Oil and gas development on wildlife refuges is neither new nor a "give-away," Interior Department officials declared last week.

The new regulations adopted December 2, under which a lease on the Lacassine, La., refuge was issued 4 days later, will provide protection and development of refuges for wildlife not possible in the past.

The department's defense was issued as members of Congress continued to call for investigation of Secretary Douglas McKay's oil policies.

The wildlife refuges comprise over 17,000,000 acres. On 3,198,000 acres no leases at all will be issued. On another 6,025,445 acres leases will be granted only after approval of development plans.

The remaining 7,840,940 acres is being studied to determine whether any of it should be put in the two restricted classes. Leases will be granted on unrestricted areas but no operations will be permitted until approved.

Leasing of the refuges was approved by Congress in the Mineral Leasing Act of 1920. A number of prospecting permits and leases had been issued when leasing was suspended in August 1953 to permit tightening of the regulations.

Leases already issued were not affected by the stop order.

Since the 1920 act provided for issuance of permits and leases, the department felt it could not keep the refuge lands out of use indefinitely. Under the former regulations the department had little control over oil operations after leases were issued. The new rules give the department complete control of operations.

The suspension of leasing in 1953 left a number of applications pending. When the new regulations were issued last month, there were 293 applications before the department.

Ratable Gas Take Nearer

● Experiment in Texas' Waskom field may be prelude to statewide rules to insure even break for all producers

AUSTIN.—The Texas Railroad Commission took another step last week in its steady but cautious drive to attain ratable take for gas in Texas.

It ordered into effect a new set of proration rules as an experiment in still another field.

The guinea pig this time is Waskom field, a prolific gas producer in East Texas.

The new rules for Waskom, so far as mechanics are concerned, are identical to those set up a few weeks ago for small Alco-Mag field of Harris County on the Texas Gulf Coast. Experience in these fields may help show the way for Texas to follow Louisiana's lead in establishing statewide ratable take.

Waskom is a much larger field than Alco-Mag and regulating gas production equitably is vastly more complicated. Alco-Mag has only about a dozen wells and only one pipeline purchaser, Industrial Gas Supply Corp.

Waskom has several hundred wells producing from half a dozen nonassociated gas reservoirs. Moreover, four large pipelines buy gas in the field. These are Mississippi River Fuel Corp., Arkansas Louisiana Gas Co., United Gas Pipeline Co., and LeCuno Oil Co.

In both the Waskom and Alco-Mag orders, the commission departed from the standard allocation system in two major instances.

In the first it overhauled completely the system of fixing allowables. In other Texas fields, the producers forecast their output and the sum of these forecasts in a field becomes the allowable.

This system would work fine if producers estimated their correct share of market demand according to field allocation formulas. But they don't. Exaggerated forecasts, which create fictitious market demands, have led to artificial over and underproduction and have shot the old system full of holes.

The producer winds up getting to produce far less or more than he is actually entitled to. And the pipeline gets first more gas than it needs, then less than it wants *(The Oil and Gas Journal, September 5, 1955, page 68)*.

The commission some years ago tried basing allowables on purchaser nominations of how much gas they wanted. That didn't work either.

Now (at Waskom and Alco-Mag), the commission will itself determine market demand by considering producers' forecasts, purchasers' nominations, monthly production history of the fields, monthly production reports, and any other relevant data.

The nonproducer problem . . . In the other major change, the commission acted to remedy another headache—that of wells in a reservoir which aren't producing because they don't have a pipeline outlet.

Years ago, a producer was pretty much at the mercy of a pipeline buyer, if there was only the one pipeline in the vicini.y. If he was to sell his gas at all (and many of them needed to sell it quickly), he sometimes had to do it at a very low price.

The commission recognized this. Its pre-Alco Mag regulation held that every well in the gas field would get its share of the field allowable regardless of whether it was connected to a pipeline.

The unconnected wells of course were unable to produce their allowables. The system then worked to reduce the total field allowable for the next month by whatever volume the unconnected wells didn't produce. After a few months of this, the pipeline was getting far less gas than it needed.

The commisison has decided now that maybe it has been giving the producer too much of a lever. The pipeline could conceivably be forced to buy at an unreasonably high price.

The new allowable system strikes what the commisison hopes will be a happy medium. Since the commission decides what actual field demand is and makes this the allowable each month, wide variations will be avoided. The unconnected producer will get his share of this actual demand or allowable. He will still have a lever, though a smaller one. The pipeline or pipelines will get only the volume of gas they want and need to buy, minus that part of the allowable not produced.

Under the new system, the pipeline would never reach the point (as it sometimes has in the past) where it could take relatively no gas at all.

The commission is pretty sure that the new system will work well in Alco-Mag field where there is only one pipeline and only two producers, one of them not connected.

It will have to wait and see in Waskom. The experiments in these two fields should soon indicate if this system will be successful and could be applied generally to other gas fields in the state.

If the new rules work, gas producers and pipeliners can certainly look for widespread application. It is not likely that the commission will apply the rules in one sweeping statewide order, however.

There is some question as to whether the commission legally could issue such an order. It could achieve about the same results by inserting the new rules in special orders on a field by field basis.

More rules coming? . . . It may be too, that the commission isn't through with Waskom yet.

If the commissioners see that the new system isn't quite all that's needed, pipelines may well be ordered to interconnect their systems.

Precedent for this has already been set. The commission inserted such a provision in a new proration set-up it ordered last summer for tiny Henze field in DeWitt County. This was the commission's first try in its current drive for more efficient and equitable gas proration *(The Oil and Gas Journal, September 5, 1955, page 68)*.

This provision relates to purchasers connected to wells with underproduction that could not be made up prior to the next 6-month balancing date. They must allow any other gas buyer in the field to purchase from the underproduced wells until the underproduction is erased.

Exactly why the commission inserted that provision in the regulations for Henze isn't quite clear since the field has only one pipeline outlet and no prospects for another. It might be that the commission was testing industry reaction.

There's no question, however, that a similar regulation would mean a great deal in a field like Waskom with its four pipelines. And it's known that the commission has been thinking seriously about applying this rule in the bigger fields.

One of these fields with an uncertain regulatory future is Carthage, the East Texas gas-producing giant in Panola County. The commission is expected to decide what to do about Carthage, which is having more than its share of proration woes, in the next few weeks. Hearings on Carthage were held last fall.

Though it is feeling its way along rather slowly, it appears the commission isn't going to stop until gas is taken ratably from every well in every Texas field. That's a big order but informed sources think not too big and not too far away either. Statewide ratable take has already been decreed for Louisiana, and officials there are in the process of putting it into effect *(The Oil and Gas Journal, December 19, 1955, page 46)*.

New Ratable-Take Plan

Culberson says gas-well production in Texas should be keyed to demand on pipelines serving each field

HOUSTON.—Commissioner Olin Culberson of the Texas Railroad Commission suggests a new way to achieve ratable gas take. He believes that gas-well production can be regulated according to the demand on the individual pipelines.

In other words, suppose John Doe Pipeline has a line taking 1 billion cubic feet per day out of the "A," "B," and "C" fields of South Texas. Under the present system, a well tied to this pipeline shares only in the production from its own particular field. And nominations for gas from these three fields are different.

As a result, the 1A Smith in "A" field is limited to only 2 million cubic feet per day. Not far away in the "B" field, the 1B Jones which has identical depth, pay zone, potential, and acreage allotment, might be allowed to produce as much as 4 million. A third well, identical to these two but in the "C" field, might be restricted to 1 million cubic feet.

However, under Culberson's proposed system, each well in all three fields would share in the total 1 billion cubic feet. Since the 1A Smith in "A" field is identical to the 1B Jones in "B" field, the allowable production from them would be the same.

This same system would be applied to each of the other pipelines purchasing gas in Texas. Wells in the Panhandle would get a ratable share of the gas taken by the pipeline serving them. Production from these wells would be in no way affected by the demands on John Doe's pipeline in South Texas.

The long view . . . Culberson, in addressing the Houston Chapter of the A.P.I., says he does not expect such a system of gas proration to be adopted soon.

The other members of the Texas Railroad Commission, General Ernest O. Thompson and William J. Murray, Jr., both favor some form of ratable gas take. However, the problem is so complex there is no general agreement as to how it should be approached.

Culberson contends that his "proration by pipeline" is a more practical solution than the attempt at state-wide control now being undertaken in Louisiana. Statewide control, he says, is a near-impossibility since gas cannot be stored above ground. The other alternatives are fieldwide regulation or the pipeline system suggested by Culberson.

Texas has had since 1947 a system of gas-producing regulations similar to those recently instituted by Louisiana. The Carthage field of Panola County, Culberson pointed out, long ago got fieldwide rules enforcing what actually amounts to ratable gas take. All other Texas gas-production rules since that time have also been on a fieldwide basis.

Probably the biggest stumbling block in regulating gas thus far has been in unrealistic nominations by both producer and purchaser. The latest experiment at ratable take is being tried in the Alco-Mag field of Harris County. A recent fieldwide ruling divides the production equally among the field's 13 wells; it does not rely heavily on producer and purchaser nominations.

Oil-Law Overhaul Favored

CHEYENNE, Wyo. — Wyoming's production and conservation laws need overhauling, in the opinion of Gov. Milward Simpson.

Gov. Simpson says the commission membership should include experts on oil and gas matters. The three-member commission now consists of the governor, state geologist, and state land commissioner.

Simpson indicated he would submit the matter to the next session of the state legislature.

Sinclair Lets Contract

INDEPENDENCE, Kans.—Sinclair Pipe Line Co. has awarded contract to River Construction Corp. of Fort Worth for building a 150-mile segment of Sinclair's new 300-mile crude pipeline in Texas.

River Construction will lay 18-in. pipe from Jacksboro to Teague, Tex. Construction will start about February 1. Completion is expected by May 1. The new line will replace parallel 8-in. lines now in use between these points.

Sinclair plans to let contract later for the Teague-to-Houston section. It will be 20-in. line replacing present 8-in. and 12-in. lines, and will connect in the Teague area with crude line from East Texas. The project will provide increased capacity to move North Texas and East Texas crude to the gulf refining area *(The Oil and Gas Journal, November 14, page 139).*

Texota Test Hits

Oil found in rank wildcat near Canadian boundary

MINOT, N. D.—Texota Oil Co. last week found oil in a rank wildcat near North Dakota's Canadian border.

The company's L. Sarah Swenson produced 310 ft. of 32° free oil, 810 ft. of gas, oil, and mud emulsion, and 30 ft. of oil-cut salt water in a drill-stem test of the Upper Mission Canyon. The interval tested was from 6,206 to 6,241 ft.

Gas surfaced in 45 minutes. Location is NE SW 22-163-93.

Another important test was preparing to begin production tests. This is the 1 Braathen, of R. M. Ballard, in Divide County, also in northwestern North Dakota. Oil was recovered in a series of drill-stem tests late last year.

A third important wildcat in this corner of the state is The Texas Co.'s 1 Donahue, 2 miles east of Williston.

A 3-hour drill-stem test from 9,546-76 in the Madison recovered 195 ft. of slightly gas-cut mud and 90 ft. of heavily gas and slightly oil cut mud.

A 60-ft. core immediately below the tested interval showed encouraging fracturing and oil staining. Coring was being continued.

Tanker Moves Alberta Oil

VANCOUVER, B. C.—Tide Water Associated Oil Co. has broken the ice on shipment of Canadian crude by tanker to California.

Tide Water purchased 118,000 bbl. of Alberta crude January 1. The oil was loaded from the Trans Mountain pipeline to a tanker bound for San Francisco. Similar shipments are expected to follow, but this particular deal was on a spot basis only.

Oklahoma Record Looms

British-American well kicks off heavy gas flow in tests at 14,997 ft.; it's a possible producing-depth mark

CHICKASHA, Okla.—Oklahoma has a red hot candidate for the state's deepest production.

The prospective new record holder is British-American Oil Producing Co.'s 2 Harrison. It is a deep test in shallow Carter-Knox field of Grady County in Central Oklahoma. Area of the drilling block totals about 3,000 acres.

On a drill-stem test of what is believed to be the second Bromide sand, the deep wildcat flowed gas at a maximum gage of 13,750,000 cu. ft. a day.

The test was conducted in open hole below 7-in. casing set at 14,931 ft. to total depth of 15,013 ft. The flow came from about 14,997 ft.

Deepest present gas production in Oklahoma is at 14,510 ft. The deepest oiler produces from 14,076 ft.

Big blow . . . British-American topped the Bromide at 14,909 ft. It began coring at 14,944 ft. and pulled 53 ft. of core to 14,997 ft. when the well suddenly began to kick.

An alarmed drilling crew closed the blowout preventers. Shut-in pressure at the surface soared in seconds to more than 2,000 psi. Gas flow through the casing drill string annulus was diverted into a bleed line and measured initially at 9,000,000 cu. ft. daily.

British-American believes the blowout was caused by restricted flow of drilling mud through the core barrel. It happened so suddenly that the crew had no chance to prevent it. By the time gas-cut mud reached the surface, the blow was right on its heels.

Heavy 14.5 to 14.7-lb. mud was mixed and pumped to bottom before the well could be brought under control. In the meantime, some circulation was lost and lighter mud was pumped into the annulus.

With things under control again, operator pulled the drill string, removed the core barrel, and prepared to run the drill-stem test.

Initial bottom-hole pressure at the start of the 41-minute test was 6,400 psi. Bottom-hole flowing pressure stabilized at 5,375 psi. Pressure built back up to 9,420 psi. on the final shut-in reading taken 96 minutes after completion of the drill stem. Bottom-hole temperature was a hot 240° F.

Crazy geology . . . British-American continued coring following the test and emerged from the sand into shale at 15,057 ft. It drilled ahead looking for the third Bromide, entered an unidentified sand at 15,139 ft. and was preparing to core again at midweek. Mud weight was being maintained at 13.2 lb. per gal.

Exact location of the 2 Harrison is 1,560 ft. from north line and 1,285 ft. from east line of 29-3n-5w. Contractor on the project is Big Chief Drilling Co. The rig is Big Chief's heavy-duty No. 30.

British-American shares interest in the deep test with Ohio Oil Co. which produces from the overlying shallow pays in Carter-Knox.

Geology in the deeper formations has proved to be extremely complex. Formations are thrust faulted and folded crazily. Bits at the 2 Harrison have passed through the same formation as many as three and four times.

Oklahoma's previous deepest producer is Denver 1 School Land in the Cogar field of Caddo County. It was completed as a gasser in 1948, producing from the Hunton at 14,510 ft.

The state's deepest oiler is Max Pray et al. 2 Billy in the Bradley area of Grady County. It was completed in 1955, producing from the Tulip Creek sand at 14,076 ft.

Governors Urged to Get Behind Gas Bill

AUSTIN. — The nation's governors have been warned that federal control of gas prices at the wellhead may mean an end to conservation and the states' historic taxing authority.

THOMPSON

In a letter to all governors, E. O. Thompson of the Texas Railroad Commission urged them to use the full weight of their office to see that Congress passes the Fulbright-Harris bill to exempt independent producers from control.

"Should the long arm of the federal Government dislodge the states in this field, heretofore reserved to the states, there could be a complete collapse of the state's taxing competency," he said.

"Free men cannot long enjoy a free economy when the fuel on which that economy runs is not free of federal price controls."

Rejection of the gas bill, already approved in the House and now facing Senate action, would also be a crippling blow to the nation's security, Thompson declared. He questioned the motives of some gas-distributing utilities which he said have revealed themselves recently as the bill's opponents.

"The utilities, by the testimony of their own spokesmen, are seeking to extend federal controls to the wells . . . to protect their competitive advantage over other fuels—not for the residential market but for the industrial market."

A fallacy of their argument, he said, is that federal control of gas prices would in no way protect or benefit the ultimate consumer. On the other hand, the Fulbright-Harris bill would establish a workable and sound federal policy and "perpetuate a policy which has worked and will continue to work for national security," Thompson concluded.

Crude System Will Expand

PORTLAND, Me.—Capacity of the Portland-Montreal pipeline system will be increased to 226,000 bbl. daily during 1956.

The crude system, expanded twice in the past 2 years, serves five refineries in Montreal East with crude brought by tanker to South Portland. A recent expansion boosted capacity from 190,000 to 208,000 bbl. daily. A new pier at South Portland also is planned this year. It will be capable of handling tankers up to 50,000 dwt.

The system includes a 12 and 18-in. line between Portland and Montreal. The U. S. portion of the system is owned and operated by Portland Pipe Line Corp. and the Canadian portion by Montreal Pipe Line Co., Ltd.

Texas Gas Expansion Set

WASHINGTON. — A $19,969,000 expansion program to enable Texas Gas Transmission Corp. to tap additional gas reserves in Louisiana was given the green light last week by the Federal Power Commission.

Texas Gas will build a 105-mile supply line from the East Lake Palourde gas field in Assumption Parish, Louisiana, to its present lines near Eunice, La. Loops also will be built along its system in Arkansas, Mississippi, Tennessee, Kentucky, and Indiana, together with additional compressor facilities totaling 19,190 hp.

the pipeline system suggested by Culberson.

forming area (*The Oil and Gas Journal, November 14, page 139*).

peeled to follow, but this particular deal was on a spot basis only.

Richfield Asks Vote

● Referendum petition filed to force California election on unitization; two earlier proposals were defeated

LOS ANGELES.—Richfield Oil Corp. has moved to place the issue of a state oil conservation law squarely up to California voters.

The company last week filed an initiative petition at Sacramento calling for a referendum. If the proposal is approved by the attorney general, it will go on the general election ballot November 6.

Twice before California voters have defeated similar proposals submitted by the state legislature. The Sharkey bill was defeated in 1932, and the Atkinson bill in 1939.

The present initiative petition, however, differs sharply from the others. It does not permit market demand curtailment or proration.

Richfield President Charles S. Jones says the new proposal "is designed solely to give the oil industry legal tools." Jones and R. W. Ragland, Richfield vice president, sponsored the petition. Jones gives this further rundown on his proposal:

"It will enable a majority of operators in a field to bring about practices which will prolong immeasurably the life of the field.

"Not enough new pools are being discovered in California to keep oil production equal to ever-increasing demand. There is one way to increase reserves of recoverable oil. That way is unit operation in as many oil pools as possible. The law is needed to facilitate unitization."

The filing climaxed a 2-year public information program carried out by Richfield engineers. They appeared before service clubs, women's groups, community leaders, and conservation groups. Each was told how physical waste of oil could be prevented.

What it provides . . . Highlights of the proposed measure include:

. . . **A three-man** appointed commission serving 4-year terms.

. . . **Two members initially** would be the supervisor and deputy supervisor of the state's oil and gas division, duties of which will be taken over by the new body.

. . . **Two members of future** commissions must be petroleum engineers with 10 years' experience, or production men of similar experience.

. . . **Authority** is given the commission to prevent waste and make any order necessary or proper for that purpose. Waste is defined as improper production practices which cause a reduction in the maximum economical recovery of oil and gas from a pool.

Other practices . . . The Richfield plan also allows well spacing and, pooling as well as unit operation.

The new agency could set well-spacing rules in pools discovered after the act became effective. Where there are two or more ownerships in a drilling unit, it also could require pooling. However, if operators agree to abide by pool rules designed to prevent waste, the commission cannot set the well spacing.

Unit operation probably is the most important provision of the act. The commission is not empowered to initiate unit operations in a pool. But where 75 per cent of the operating and royalties interests request unitization, it may order the minority to enter the agreement.

In fact, three other requirements are set up before the commission even can consider a unit plan. They are:

. . . **Productive limits** must be reasonably outlined by drilling and all of the pool must be included in the proposed unit.

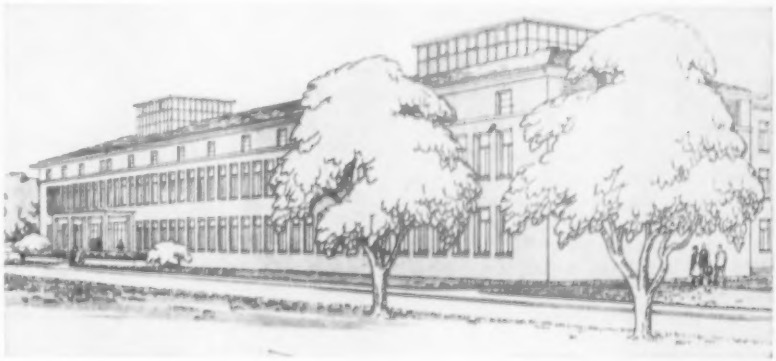
. . . **Unitization must be** necessary to carry out pressure maintenance or other secondary-recovery operations.

. . . **Value of additional oil** to be recovered by unit operations will exceed extra costs to be incurred.

Role of state . . . Of special significance is a provision that the state and its political units may become parties to a unit agreement.

Currently Long Beach is faced with a land subsidence problem which engineers believe can be cured only by field-wide pressure maintenance. Unitization would help meet the problem.

Court review of commission orders also is provided and agreements for pooling of interests in spacing units and unit operations shall not be held to violate state antitrust laws.



Esso Doubling Big Research Center

BATON ROUGE.—The increasing role of science in oil was underscored again last week.

Esso Research & Engineering Co. announced it will double office and laboratory space at its research center here with a new $1½-million building. The three-story T-shaped structure will house expanded facilities for exploring advanced concepts in X-ray, electronic and spectrographic analysis. A section will be provided for research employing radioactive materials.

The building will be 130 ft. across the front, and 55 ft. wide. The rear wing will be 103 ft. long and 58 ft. wide. Adjoining the main laboratory building, it will house laboratory and office space for about 150 scientists and technicians. This will centralize Esso Research activities, now carried on in various areas of Esso Standard Oil Co.'s giant Baton Rouge refinery.

A feature of the new project will be a special laboratory equipped with high speed computing machines. These electronic "brains" are being more and more widely used to analyze and coordinate research activities in the laboratories here.

Esso's Baton Rouge laboratories are widely noted for pilot plant and semi-commercial operations in petroleum research. Early development work in fluid catalytic cracking, hydrocarbon synthesis, fluid coking, butyl synthetic rubber, petrochemicals, and fluid Hydroforming was carried forward here.

L.P.G. Supply Tight

Cold weather, failure of distributors and consumers to stock up early, combine to create transportation problem

TULSA.—Early onslaughts of winter weather in the Middle West and East have skyrocketed demand for L.P.G. Many suppliers fear that continued cold weather may result in shortages in some areas.

Key to the problem is transportation. L.P.G. companies say there is a shortage of railway tank cars to move the fuel into areas of heavy demand. There appears to be ample supplies to meet the need.

One L.P.G. broker reports tank cars are becoming increasingly difficult to get for movement from the Southwest to the Northeast. He says factors contributing to this shortage are use of cars in moving butane to refineries and slow return of cars already in the Northeast.

The lack of tank cars, however, may ease somewhat in January when butane movement to refiners is expected to ease off. However, slow turnaround of cars in distributors' yards could still complicate the situation.

Shortage possible . . . One L.P.G. products supplier says if severe weather continues through January and February a shortage of supplies could develop. He reports the unprecedented demand is drawing down storage at a rate which many producers might not be able to replenish in a short time.

One major supplier, Warren Petroleum Corp., says it is having no trouble meeting its contract commitments and has sufficient transportation and supplies to carry through even a severe winter. Warren has its own tank cars plus sea-going tankers and barges to move L.P.G. into the Northeast, Southeast, and Midwest.

G. L. Brennan, Warren vice president, says Warren already has orders for more tank cars for delivery in 1956.

Since the bulk of L.P.G. is sold by contract, the heavy demand early this winter has not affected general prices. Spot prices have moved up some. Dealers or consumers forced to supplement contract purchases with spot market deals may suffer.

However, the "summer bust and winter boom" in L.P.G. is nothing new. The industry has striven for years to level out these differences in demand by increased underground storage and larger dealer and customer storage.

The mild winters of the past few years have caused some distributors to ease up on this campaign and they may get caught short if severe cold continues this year.

The L.P.G. industry entered the current heating season, however, with larger stocks in storage than last year. Total storage on October 31 was 474,795,000 gal. compared with 381,400,000 the same date last year. This included propane, butane, and mixtures stored at terminals, refineries, plants, and underground.

While the number of customers at the end of 1955 was 3.9 per cent less than for the same date in 1954, sales showed a 9.2 per cent increase over 1954.

Some observers believe the heavy draw on stocks this winter will make L.P.G. sales good during the normally slack 1956 summer season.

A.A.O.D.C. sizes up trends:

Footage Rate Down Again in '55

DALLAS.—The cost of drilling and completing a well continued to rise last year, but the actual cost of drilling took another drop.

This is the conclusion of the American Association of Oilwell Drilling Contractors.

The average footage cost for drilling last year was $4.90, the A.A.O.D.C. figured, 20 cents cheaper than 1954 and 10 cents under the average rate of 20 years earlier. According to the association, operators in 1955 got their biggest bargain in contract drilling since 1949.

Higher priced tubing and casing and cost increases in other equipment, however, raised to $13.50 a foot the average total cost of drilling and completing a well, according to A.A.O.D.C. figures.

The association estimated 57,500 completions for the year *(This is about 1,000 more than final Oil and Gas Journal figures will show in the January 30 issue).* The association set the average well depth at 4,044 ft., 19 ft. deeper than the 1954 average.

The study shows drilling time has been cut nearly in half since 1941.

Comparison of Drilling Costs

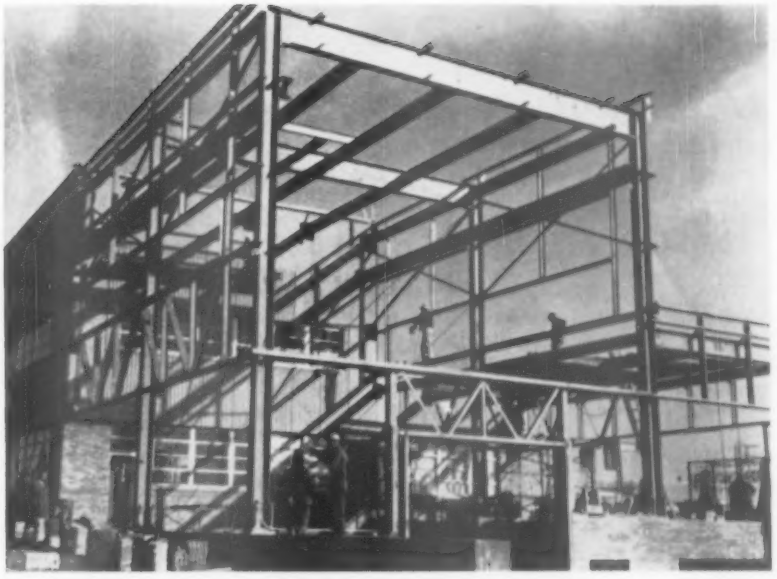
(Per cent)

	1941	1945	1947	1948	1949	1950	1951	1952	1953	1954	1955
Labor	100	140	150	170	180	190	196	197	198	200	202
Equipment	100	110	132	145	160	175	180	183	188	190	195
Miscellaneous	100	120	160	165	170	175	181	185	188	191	194
Total rotary drilling	100	122	145	160	170	180	186	189	192	194	197
Drilling prices (footage basis)	100	115	110	105	101	100	103	103	102	99	96
Average drilling time (days)	100	95	85	80	75	65	60	59	58	56	56
Rate of penetration	100	110	130	140	150	170	180	182	184	188	188

Drilling Trends In the United States

Year	Total new wells completed	Average depth per well	Average contract cost per foot	Average total cost per foot	Per cent work done by contractors
1935	24,851	2,760	5.00	8.00	68
1936	28,962	2,797	4.75	7.75	69
1937	35,213	2,985	4.50	7.50	71
1938	29,127	3,110	4.25	7.50	71
1939	28,012	3,053	4.25	7.50	70
1940	31,149	3,088	4.00	7.50	71
1941	32,510	3,056	4.25	7.25	72
1942	21,990	3,088	4.00	7.50	70
1943	20,349	3,046	4.50	8.00	75
1944	25,786	3,272	4.75	8.25	78
1945	26,649	3,489	5.00	9.00	80
1946	30,230	3,345	5.00	9.50	81
1947	33,147	3,404	5.00	10.25	81
1948	39,477	3,463	4.75	10.75	82
1949	38,962	3,558	4.75	10.75	85
1950	43,204	3,689	5.00	11.00	88
1951	44,196	3,869	5.50	11.50	90
1952	45,879	4,060	5.85	12.00	91
1953	49,279	4,016	5.60	12.50	91
1954*	53,650	4,025	5.10	12.75	92
1955†	57,500	4,044	4.90	13.50	92

*Corrected. †Estimated.



Stanolind Expands Well-Testing Lab

TULSA.—Stanolind Oil & Gas Co. is doubling the size of its heavy experiment laboratory building in southeast Tulsa.

The new addition will be completed in early February. It will expand Stanolind facilities for research in drilling muds and fluids, corrosion, and secondary recovery.

The structure will measure 40 by 50 ft. and will be 40 ft. high. It will house a 5-ton traveling crane in the ceiling and three experimental wells in the basement. The test wells—100, 200 and 800 ft. deep—will simulate field drilling tests, evaluate subsurface field equipment, and test flow characteristics of mud and other fluids.

Wells also will provide a method for testing corrosion inhibitors and when capped and sealed become efficient, large-scale pressure chambers.

Stanolind officials say the drilling test program is aimed at establishing a "drillability index" for accurate plotting of mud and drilling programs in the field. The test wells allow more accurate simulation of field conditions at less cost and still allow most advantages of smaller scale laboratory tests.

Gas and Imports Scraps Begin

WASHINGTON.—Congress opened its 1956 session last week and the Harris gas bill and oil imports immediately got star billing.

The last round of the fight to get independent gas producers out of the Federal Power Commission's hands started with a blast at "certain eastern utilities" by Sen. A. S. Mike Monroney of Oklahoma.

Monroney charged that certain well-heeled eastern distributors are "attempting to divert public attention from their own responsibility for high consumer gas prices by attacks on natural-gas producers in the Southwest."

Monroney supported the newly formed Joint Committee of Consumers and Small Producers headed by former Mayor Alex M. Clark of Indianapolis. He said the committee could perform a great public service by bringing the true facts of the situation out.

"The natural-gas bill now pending in the Senate amply protects both the producer and the consumer," Monroney said. "It effectively prevents unreasonable increases in the producer's price of raw gas. More important, it prevents the dead hand of regulation from stifling the exploration necessary to find additional supplies of natural gas."

The imports question was raised by Rep. Robert C. Byrd of West Virginia.

"World tension, coupled with continued unemployment in our coal fields, makes a quota restriction mandatory," he said.

Byrd voiced the hope that the administration will recognize "the futility of placing reliance upon foreign fuels while domestic industry is being sacrificed."

Pipeline BRIEFS

NEW YORK.—U. S. steelmaking capacity is up 2½ million tons over last year to more than 128 million tons. And expansion is continuing, according to the American Iron & Steel Institute, to keep up with booming demand. Mills started off the new year behind on deliveries of oil-country tubular goods. The supply situation should remain tight throughout 1956 under pressure of increased drilling.

BRUSH, Colo.—Arapahoe Pipe Line Co. will expand its facilities in Colorado, Kansas, and Nebraska late this month with purchase of 420 miles of pipelines and gathering systems.

Arapahoe will acquire a 33-mile, 10-in. crude line from Adena field to Merino, Colo., together with gathering lines from Pawnee Pipe Line Co. It also will add 42 miles of 8-in. from Little Beaver field to Merino and a gathering system. This will be bought from Goodall Pipe Line Co.

About 345 miles of oil field gathering lines will be acquired in Kansas and Nebraska. All of them feed into the Arapahoe system. Sellers were not identified.

IGNACIO, Colo. — Tennessee Gas Transmission Co. last week submitted a high bid of $267 per acre for lease on 1,280 acres of Ute Mountain Indian land in San Juan County, New Mexico. The record bonus totaled $335,760. The lease is in the area where El Paso Natural Gas Co. recently brought in an oil discovery which tested 70 bbl. daily. Bonus offers on 31,000 acres at the sale totaled $1,400,000.

HOUSTON.—A proposal to increase the number of authorized shares of stock in Tennessee Gas Transmission Co. will be presented to stockholders at a special meeting February 7.

The plan, recently approved by the board of directors, would increase authorized common stock by 15,000,000 shares. Authorized preferred stock would be increased by 1,000,000 shares of a new class.

PHILADELPHIA.—Atlantic Refining Co. will merge its three pipeline subsidiaries to simplify the corporate structure and effect administrative economies.

Atlantic Pipe Line Co., which gathers and transports crude in Texas, New Mexico, and Louisiana, and Buffalo Pipe Line Corp., a New York products carrier, will be merged into Keystone Pipe Line Co., which transports products in Pennsylvania.

The name of Keystone will be changed to Atlantic Pipe Line Co.

Output to Rise in '56

● Bureau of Mines sees a 4.5 per cent gain in domestic demand, higher imports, 3.2 per cent hike in production

WASHINGTON. — U. S. crude-oil production averaged 6,775,000 bbl. daily during 1955, 6.8 per cent above the previous year, and a 3.2 per cent gain is forecast for this year.

The outlook is presented in a report by the Bureau of Mines, which figures 1956 crude output will be 6,994,000 bbl. daily.

Although the prospective increase this year is less than half of 1955, it represents a return to normal growth by the industry. Last year's abnormal gain was made on a relatively low base as 1954 production suffered a 1.7 per cent setback.

Total value of crude output at the well was placed at $6,847,000,000, against $6,427,000,000 in 1954. All of the gain was from increased production. The average well price was estimated at $2.77 per barrel for both years.

Total demand for all oils was up 7.6 per cent last year, in contrast to an increase of only 1.3 per cent in 1954.

Marketed production of natural gas was estimated at 9,300,000,000 M.c.f. The average value was placed at 10.7 cents per thousand cubic feet compared with 10.1 cents in 1954.

The bureau estimated natural-gasoline production at 131,000,000 bbl., a gain of 3.6 per cent. Production of liquefied petroleum gas was put at 130,000,000 bbl., an increase of 7.4 per cent. The average value was slightly higher for natural gasoline, slightly below 1954 for L.P.G.

Imports to increase . . . The bureau expects total imports to increase 7 per cent over 1955 to an average of 1,331,000 bbl. daily.

The same percentage gain is anticipated for crude and products imports, with the daily crude average to be 836,000 bbl. and refined products 495,000 bbl.

While the upward trend of imports will continue, its rate of increase will be slowed sharply, according to the forecast. Last year saw crude imports soar 19 per cent above 1954 and products rise 17 per cent. But these steep gains came on the heels of very slight increases in 1954 when total imports were up only 1.7 per cent.

With the increase in imports, the new supply is expected to rise 4 per cent to 9,087,000 bbl. daily against 8,738,000 bbl. daily during 1955.

U. S. Supply and Demand All Oils

(Thousands of barrels daily)

	1954 actual	Per cent change	1955 estimated	Per cent change	1956 forecast	Per cent change
Production	7,027	— 1.2	7,494	6.6	7,756	3.5
Crude	6,346	— 1.7	6,775	6.8	6,994	3.2
Other oils	681	4.0	719	5.6	762	6.0
Imports	1,052	1.7	1,244	18.3	1,331	7.0
Crude	656	1.3	781	19.0	836	7.0
Refined	396	2.4	463	17.0	495	7.0
New supply	8,079	— 0.8	8,738	8.2	9,087	4.0
Change stocks	—29		17		27	
Crude	—44		0		0	
Products	15		17		27	
Total demand	8,108	1.3	8,721	7.6	9,060	3.9
Gasoline	3,487	2.3	3,701	6.1	3,842	3.8
Residual	1,504	— 6.4	1,595	6.0	1,584	— 0.7
Distillate	1,508	5.8	1,647	9.2	1,754	6.5
Kerosine	338	1.2	326	— 3.4	328	0.6
All other	1,271	3.2	1,452	14.2	1,552	6.9
Exports	356	—11.3	370	3.8	333	— 9.9
Crude	37	—31.9	32	—15.3	27	—13.6
Refined	319	— 8.1	338	6.1	306	— 9.5
Domestic demand	7,752	1.9	8,351	7.7	8,727	4.5
Gasoline	3,393	2.7	3,605	6.3	3,754	4.1
Residual	1,430	— 6.8	1,505	5.1	1,516	0.7
Distillate	1,442	7.8	1,577	9.3	1,686	7.0
Kerosine	324	3.3	316	— 2.4	320	1.0
All other	1,163	4.4	1,348	15.9	1,451	7.6
Crude runs	6,958	— 0.6	7,471	7.4	7,746	3.7

Export to fall sharply . . . But exports are due for a sizable dip.

Total exports are expected to fall 9.9 per cent, compared with last year's 3.8 per cent increase. Crude will lead the way in the decline with 13.6 per cent while refined products exports are due for a 9.5 per cent drop. Of the 32,000 bbl. daily products decline, 22,000 bbl. daily will be residual.

Total demand is scheduled to increase across the board, with the exception of residual fuel, which is marked for a 0.7 per cent decrease. More resid would be consumed if it were available. The decline is forecast on the basis of continuing lower refinery yields of this heavy fuel, plus the fact there is no surplus on the world market.

Total demand should rise 3.9 per cent to 9,060,000 bbl. daily.

Domestic demand for 1956 is set at 8,727,000 bbl. daily, an increase of 4.5 per cent.

Crude runs to stills are due to rise 3.7 per cent to 7,746,000 bbl. daily.

Rate "Freeze" Ordered

AUSTIN. — A temporary injunction restraining the Texas Railroad Commission from lowering freight rates for some pipe carried intrastate by truck apparently has left the commission undaunted.

The commission has warned truckers that they must keep the difference between the old rates and the new rates in a suspense account pending outcome of the litigation brought by the Oilfield Haulers Association.

The old higher rates remain in effect by court order on all shipments within Texas except those originating at Lone Star or at a number of points on the Gulf Coast.

Independent Firm Formed

FORT WORTH.—Ambassador Oil Corp., with $18,000,000 in assets, has been formed to produce and explore for oil on properties of F. Kirk Johnson, Fort Worth; Brooks-Scanlon Oil Co., Minneapolis; actor Jimmy Stewart, Los Angeles; and Deane Gill, Oklahoma City.

Present production will gross about $2,000,000 a year. Ambassador plans to operate initially in Texas, Oklahoma, Kansas, Nebraska, North and South Dakota, Montana, Wyoming, Colorado, Utah, Nevada, New Mexico, and Alaska. Johnson is president, and Luther Hudson, Fort Worth, executive vice president. Other vice presidents are Gill; Paul Kennan, Chicago; and C. Harrison Cooper, Kenneth Smith, Curtis McBroom, and W. V. Coffey, all of Fort Worth.

Voluntary curbs working? . . .

. . . Imports Checkup Is Coming

WASHINGTON.—The Cabinet fuels committee will meet next week for another look at the oil-import situation.

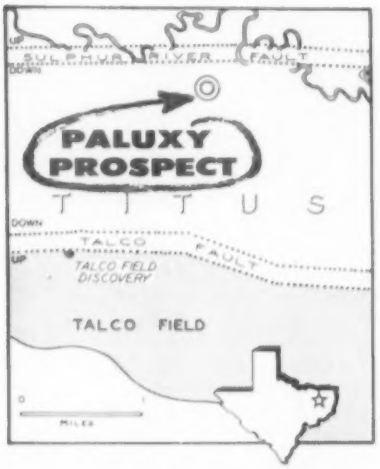
Early results of Mobilization Director Flemming's appeal to the importers to make a 7 per cent cut in crude imports from areas other than Canada and Venezuela will be studied.

Flemming has not revealed what those reports showed. But industry observers do not believe that any substantial reduction was made in the early days of the drive to get imports down.

The 7 per cent cut was asked by Flemming in an October 29 letter to importers. He said the reduction should be made during the final quarter of 1955 and continued during the current quarter. Later he called on the companies to submit monthly reports of their actual imports and programs for the subsequent 5 months.

Only the first report, covering November imports and programs through April, has been received so far. The December report is not due until January 15, and the Cabinet committee will meet before it can be analyzed.

Congressmen from the coal-producing states already have declared their intention of working for a bill setting up a quota system for imports. They charge that the administration's effort under the national defense provision of last year's Reciprocal Tariff Act has been ineffective in getting any real restrictions.



New Paluxy Find?

East Texas well believed on Sulphur River fault

MOUNT PLEASANT, Tex. — Prospects of a new Paluxy sand pool similar to the big Talco field in northern Titus County is stirring the interest of East Texas operators.

Geological significance is attached to the well because it appears to be on the Sulphur River fault which parallels the Talco fault to the south.

The wildcat prospect is the 1 Flo Lewis of John B. Stephens, Jr., Mt. Pleasant, and R. L. Peveto, Tyler. Location is in the M. V. Delgado Survey, 4 miles northeast of Talco townsite.

Paluxy oil was developed on a 30-minute drill-stem test at 4,682-98 ft. Recovery in the pipe was 1,078 ft. of 35°-gravity oil, plus 360 ft. of mud cut with salt water. This compares with Talco field oil which has a maximum 25° gravity and is found around 4,300 ft.

Successful completion at 1 Lewis may set off a new drilling play along the Sulphur River fault. Lease buying has been influenced by the well as far east as Bowie County, north into Red River County, and west into Franklin County.

Texaco Probe Promised

DENVER. — The Senate antitrust subcommittee may investigate the stock holdings of officers and directors of The Texas Co.

Sen. Joseph C. O'Mahoney of Wyoming revealed the move last week. He informed the Oil, Chemical and Atomic Workers International Union he also will ask his group to investigate union charges against Texaco.

O. A. (Jack) Knight, O.C.A.W. president, asked O'Mahoney to check on a Texaco rule prohibiting workers from owning major interests in competing firms. Knight claimed the regulation violated free enterprise. He said workers at Texaco's Port Arthur refinery would strike if the rule is enforced.

O'Mahoney telegraphed Knight the regulation appears to violate "the economic independence of Texas employes." The senator said a Texaco explanation did not justify the rule. Texaco said the order does not apply if the firm in which an employe owns interest "is large enough that the ownership could not reasonably be expected to influence the employe to act in conflict with the interests of The Texas Co."

Industry BRIEFS

CALGARY.—Alberta has raised its crude production allowable for January to a record 371,708 bbl. daily. The December figure set by the Alberta Petroleum and Natural Gas Conservation Board was 358,310 bbl. daily. Pembina field was boosted 3,210 bbl. daily to 73,925, Redwater 2,125 bbl. daily to 76,626, and Leduc-Woodbend 1,342 bbl. daily to 59,220.

CODY, Wyo.—Richfield Oil Corp. has asked the U. S. Forest Service and Bureau of Land Management to reconsider an order prohibiting drilling for oil in the North Fork canyon of Shoshone National Forest. Richfield holds several leases inside the forest and planned extensive drilling next spring. But the federal agencies have held that oil activity would destroy natural beauty of the recreation area and thus be against the public interest.

BURBANK, Calif. — Crestmont Oil Co. has acquired the leasehold interest of Ferguson and Bosworth in the Kern Bluff oil field in Kern County. The property consists of 12 producing wells on 250 acres. It will increase Crestmont's gross daily production by 250 bbl. to 1,600 bbl. and net proven reserves by 610,000 bbl. to 6,700,000 bbl.

ANDREWS, Tex.—Phillips Petroleum Co. has started construction of a $7,000,000 natural-gasoline plant 3 miles west of here to gather casinghead gas from about 16 oil fields in Central, South, and Northeast Andrews County.

Construction contract is held by Gasoline Plant Construction Co. The new plant, along with gathering lines and a booster station, is slated for completion next summer.

NEW YORK.—Synthetic-rubber production during November hit a new peak for the second month in a row. Output was 91,249 long tons compared with 87,764 long tons produced during October. GR-S production rose from 72,499 to 74,939 long tons in November, according to figures from the Rubber Manufacturers Association, Inc. Synthetic-rubber consumption in November totaled 82,080 long tons against 53,001 long tons of natural rubber.

CALGARY.—Shareholders of Home Oil Co., Ltd., and Federated Petroleums, Ltd., have voted to merge. Home will acquire the assets of Federated on the basis of two shares of Federated for one of Home. The merger gives the firms more than 27,000,000 bbl. crude reserves and current production of 6,700 bbl. daily.

Showdown at Crossroads

● Pipeliners tired of paying for relocations as highway building booms; so they seek new policy in Houston area

HOUSTON.—For a long time pipeline companies in Texas have paid the costs of moving their lines to make way for new highways and county roads.

They think the county treasurer should stand the bill. But they've always gone along paying, even though it cost them as much as $250,000 in a single year. Pipeliners claim the legal right to refuse to pay. They figure, however, it's good public relations to avoid a fight, especially when the costs are relatively small.

But for the past year pipeline companies have grown more and more unhappy about the practice. A showdown is taking shape in Harris County where a big road building program is crossing a vast network of pipelines.

Who's involved . . . Participants in the current disputes are Tennessee Gas Transmission Co., Sinclair Pipe Line Co., and American Oil Pipe Line Co.

Two issues are directly involved:

. . . The county's right to make pipelines file applications when crossing public roads.

. . . Who pays for moving existing pipelines to conform to the county's road program.

T.G.T. in the first case proceeded to cross Harris County roads with its 30-in. interstate line without applying to the Commisisoners Court for a permit. The county went to court, citing a 1947 road law which gave it the right to grant right-of-way on county roads, set up restrictions and assess fees. The county lost its request for an injunction. But the case appears headed to the state Supreme Court.

In the second case the pipeline firms protested when the county bared plans to run a new parkway across their lines. Sinclair and American wanted to know who would pay for lowering and casing the lines. Both firms performed the work with financial responsibility subject to later litigation.

What's at stake . . . Millions of dollars in future costs may be involved in the issues revolving around county's jurisdiction over pipeline right-of-way.

Pipeliners can count on many new roads cutting across their lines. Highway building and freeway construction are mushrooming around cities. A federal highway program may step up the activity.

Many crossings cost the pipeline firm $5,000. To lower a 12-in. line 6-7 ft. below the natural ground surface and case with 16-in. pipe for 400 ft. costs a minimum of $7,500 to $10,000.

Pipeliners say they're willing and happy to pay for expenses involved in crossing any road along their route. A new road or wider road is different. They agree the county should bear all the expense of the relocation work on a new road and the pro rata cost of a widening job.

What's the law . . . In Texas, unlike other states, right-of-way acquisition is handled by local agencies.

With these agencies often involved in setting tax rates and valuations they have what amounts to a club over pipeline companies. Under the special 1947 law, Harris County assessed a $10 yearly fee for each pipeline road crossing. A bond was also required for each crossing and detailed plans were required to be filed prior to construction. In addition, the regulation required the pipeline firm to stand costs of all later alterations.

Pipeline attorneys claim the regulation is unconstitutional. They cite a long list of Supreme Court cases holding a local government agency cannot prevent an interstate pipeline from crossing a highway. It follows, they contend, that the agency has no right to issue permits for such crossings, for the right to issue a permit implies the right to deny it.

On the issue of intrastate pipelines, the lawyers argue that the right to cross highways is granted by the legislature rather than by the county. They also point to a Texas attorney general's opinion in 1938 holding that the county is liable for relocating lines for new roads.

Both sides may seek relief before the legislature. The county may seek laws requiring public monies to be used only in actual road construction, allowing counties to charge for right-of-way crossings and use, and assessing new taxes on transmission lines.

The threat of heavy taxes has made pipeliners tread softly in the long-smouldering disagreement. One solution they advance is a new law declaring an existing utility line to be a construction obstacle rather than a right-of-way obstacle. This would permit pipeline companies to negotiate with the state highway department, a nontaxing agency, rather than locally.

Anyway you look at it, the pipeline firms are in a touchy spot. Do nothing and they will wind up paying the bills for scores of expensive line relocations. Stir up a big fight and they may be slapped with higher taxes. There'll be plenty of attempts at friendly negotiating but the issues may eventually wind up before the Texas Legislature or the state Supreme Court.

Tank Rates Revised

Truckers win changes on oil products tariffs

AUSTIN.—The Texas Railroad Commission has revised motor-freight rates on a number of petroleum products following a hearing asked by the Texas Tank Truck Carriers Association.

The commission order:

. . . **Changes minimum charge** per tank truck hauling liquefied petroleum gas to 90 per cent of gallonage capacity of the truck at the applicable rate per gallon. When truck is carrying more than 90 per cent of its capacity, the minimum charge will be based on the number of gallons carried.

. . . **Makes grease subject** to an estimated weight of 8 lb. per gallon, and "petroleum distillate, product of gas well," subject to estimated weight of 6.6 lb. per gallon.

. . . **Changes propane and propylene rates** from Deer Park to Freeport and Velasco and propylene mixture rates from Freeport and Velasco to Deer Park from 8.5 cents per 100 lb. to $0.00561 per gallon. It also makes all of the rates per gallon in Item No. 115-A subject to the minimum bases set out for L.P.G. (above).

. . . **Removes** "petroleum distillate, product of gas well" from the rate schedule in Item 95 and puts it under the Item 90 schedule.

Spraberry Pools Combined

MIDLAND, Tex.—All Clear Fork production in the Spraberry Trend Area field is being combined into one area.

Now considered as one pool are the Spraberry Trend Clear Fork, the South Spraberry Trend Clear Fork, and the West Spraberry Trend Clear Fork.

The Railroad Commission has set up proration units for the new field identical to those in the lower Spraberry sand zone in the trend. This creates 80-acre units with an 80-acre tolerance for each well. MER also is the same at 121 bbl. per well on 80 acres and 212 bbl. per well on 160 acres.

The approved allocation formula is based on 75 per cent acreage and 25 per cent well. The formula also provides that wells previously drilled, drilling, or completed to the Clear Fork on a 40-acre unit shall have an allowable equal to that of a well on 80 acres if the well cannot be assigned a full 80-acre unit.

Operators in the trend are given permission to commingle Clear Fork and Spraberry casing head production allocated to the two reservoirs.

WATCHING WASHINGTON

Bertram F. Linz

Uncle Getting Tougher

The Justice Department is stepping up its enforcement of the anti-trust laws.

It has increased the number of cases filed. And it isn't agreeing to nolo contendere pleas, except where defendants are too old or too ill to take a chance of going to prison.

Defendants entering nolo pleas in effect throw themselves on the mercy of the courts. And department officials feel the courts have been too merciful. Nolo pleas usually have brought light fines and no stigma.

The department believes that when a man is charged with anti-trust violation he should stand trial. If guilty, he should be punished and his guilt published.

The courts, too, are coming around to this view. Last year a New York judge held a nolo plea is an admission of guilt and the defendant is subject to sentence in the same manner as if he had either pleaded guilty or been found guilty after jury trial.

The department went into high gear last year. It filed new cases at the rate of one a week.

Million-Dollar Contest

Mobilization Director Arthur S. Flemming proposes that business and industry put up $1,000,000 a year for awards to scientists and engineers who contribute the most towards maintaining this country's leadership in technology.

The U. S. is not only lagging in the training of an adequate new supply of scientists and engineers, Flemming believes. We are not making the best use of those we have, he feels.

To meet the problem of expanding mechanization, we must first raise the level of management competence in business, government and education, Flemmings says. A real effort must be made to utilize trained personnel more effectively. Our educational system must be strengthened to give better training to more students. And we must adopt programs that will give national recognition to those who excel in scientific and engineering fields.

The proposed $1,000,000 would make the last possible. Flemming suggests that awards might go to students for superior performance, to teachers for outstanding contributions in education, to scientists and engineers for distinguished contributions in their field and to executives who make those contributions possible.

Peace Emissary

Florida Atty. Gen. Richard W. Ervin will come to Washington this week to seek a peaceful solution of controversies over the state's boundaries.

At stake is a broad area off Florida's southernmost tip where both state and federal officials claim oil and gas rights. The state claims title to the waters between Key West and Dry Tortugas Island, 65 miles away. It also claims some 30 small islands, none much over 6 acres in extent, along the line of the Florida Keys.

The California Co. bought an exploration contract for $1,000,000 last year. It covers a broad strip running along Florida's Gulf Coast, including a strip 12 miles wide and nearly 50 miles long in the disputed area.

The Interior Department claims that some of the leased area doesn't belong to the state.

Coal Aims: A Challenge

It's going to be a tough year for oil importers and natural-gas pipelines if the coal industry can make it that way.

The National Coal Association, spokesman for the producers, announced its 1956 program last week. Three of its five objectives will hit the oil and gas industry. A fourth would halt the use of government funds for building plants for commercial production of nuclear power.

A cutback of "still excessive" oil imports is still No. 1 on the association's program. Only slightly less important is amendment of the Natural Gas Act to stop the "dumping" of gas for use under industrial boilers.

With changes in Government policies to end claimed discriminations against coal in Government-owned plants and buildings the association believes the competitive situation would be equalized.

Better gasoline from its Panola plant is the object as . . . .

Arkansas Fuel Adds a Reformer

SHREVEPORT.—Arkansas Fuel Oil Corp., Shreveport, La., has let construction contract to Procon, Inc., for a new 900-bbl. Platforming unit at its Panola natural-gasoline plant at Carthage, Tex.

The new unit, set for completion in May 1956, will upgrade the plant's present motor gasoline from its topmost octane value (research) of 82 with 3 cc. of tetraethyl lead to a top of 98 with 3 cc. of lead.

A new feed-preparation unit for the Platformer also will be built. Design work on the new installation was done by Universal Oil Products Co.

As is the case with most gasoline plants in the Carthage area, Arkansas Fuel Oil's Panola plant recovers substantial quantities of condensate from the wet-gas charge.

Instead of selling the condensate, as some plants do, the Panola plant has refined it and blended the resulting naphtha with natural. This gives a white motor gasoline with a clear octane of 60 at 9 lb. R.v.p. Addition of 3 cc. of lead raises the octane to a maximum 82.

How process works . . . When the new facilities go into operation, the Panola plant will charge about 42,000 gal. of this low-grade motor fuel to a fractionating column.

Most of the butane will be removed in this column. The remaining fluid will be charged to the new feed-preparation unit, which in effect is a pentane splitter. This unit will take off isopentane and some remaining butane. The butanes will be separated in a small auxiliary vessel, leaving an isopentane product of over 95 per cent purity.

The main stream (including normal pentanes) from the feed-preparation unit will be charged to the Platformer. Gases from the Platformer will be used for plant fuel. Butane will be blended back into the gasoline product from the unit to satisfy vapor-pressure specifications.

The gasoline, which can go as high as 98 octane with 3 cc. of lead, will be marketed by Arkansas Fuel Oil as regular gasoline through its own market outlets in the Shreveport area. The company also plans to sell the byproduct isopentane.

Present production of the Panola plant is about 42,000 gal. of motor gasoline, 15,000 gal. of butane and isobutane, 16,000 gal. of propane, and minor quantities of absorption oil, diesel fuel, kerosine, and other products. Rated capacity of the plant is about double these figures.

The disclosure of contract-letting by Arkansas Fuel nearly coincided with formal opening of a new $750,000 U.O.P. Platformer at the Dubach, La., natural-gasoline plant of Southwest Gas Producing Co. and Feazel Interests.

This plant will handle 195,000,000 cu. ft. of gas daily at capacity and will be able to produce a 95-octane motor gasoline. The Dubach plant was built by Fish Engineering Corp., Houston, and is reported to be only the second Platformer designed for installation at such a plant.

Reforming no cure-all . . . Reforming, however, isn't a cure-all for the industry's surplus of natural-gasoline as things stand now. Both the Panola and Dubach plants recover substantial quantities of condensate from the wet gas they process. The concensus seems to be that reforming is feasible where condensate is available to blend with natural. This is generally the case in the Carthage and some other areas.

Some plants in the Carthage area now sell their low-grade gasoline or condensate to Atlas Processing Co. It employs reforming facilities similar to the planned Arkansas Fuel Oil unit to upgrade the gasoline at its Shreveport plant.

Reforming isn't believed applicable now at plants making no condensate or cycle product. This eliminates the bulk of them and likely will preclude any wholesale rush by plant operators to install such facilities.

Farmers Win Gas Fight

OKLAHOMA CITY. — The Oklahoma law requiring operators of natural-gas wells to furnish gas at cost to property owners on whose land the well is located has been upheld by a special federal court.

The three-judge panel dismissed a suit filed by Phillips Petroleum Co. to contest constitutionality of the law. Phillips had filed the suit against a group of Texas County farmers and ranchers who had been granted a federal court injunction. The writ prevented Phillips from cutting off gas used for operating irrigation pumps.

In its opinion, the court held the law is within the police powers of the state. It imposes obligations on gas producers. They must sell to farmers on a priority basis and on terms set by the state corporation commission.

Career Pointers Prepared

WASHINGTON.—The young man trying to pick a career in the oil industry can get some pointers next year from the Bureau of Labor Statistics.

The agency has launched a new survey of major industries under direction of Sol Swerdloff, chief of the industry studies branch. The object is to learn the job prospects in each and to determine other factors on which young people can plan their life work.

Company and trade associations in the production and refining segments of the oil industry are being contacted for information. The statistics are being collected by Robert J. Rosenthal, labor economist.

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Jamaican Venture Near

Stanolind taking over Base Metals concession covering entire island, will expand oil search already under way

STANOLIND OIL & GAS CO. is ready to start its second major exploration program in the Caribbean.

Stanolind officials were in Jamaica last weekend, ostensibly to complete agreements with the government and Base Metals Mining Corp., Ltd., to take over Base Metals' exclusive concession on which one wildcat with promising shows has been drilled.

Formal closing of the deal, announced by Base Metals in October, has been held up while changes in the exploration license were made to satisfy Stanolind objections *(The Oil and Gas Journal, October 31, page 68)*.

The weekend conferences should clear away all red tape and pave the way for the Tulsa-based company to start its exploration program which calls for expenditure of at least $2,000,000 by June 21, 1958. Stanolind, producing subsidiary of Standard Oil Co. (Ind.), has already embarked on a $10,000,000 search for oil in Cuba, largest in the island's history.

Contract terms . . . Stanolind is required to operate through a local subsidiary.

The company will continue and expand the exploration begun by Base Metals, a Toronto firm headed by Franklin D. Roosevelt, Jr., whose license covered some 5,500,000 acres of the island and its tidelands.

Base Metals retains a 25 per cent interest in the concession, having received a substantial sum of cash in the deal, with no obligation to pay development costs until production is found.

Of the $2,000,000 commitment, $500,000 must be spent in the first 9 months on geological and geophysical survey work. At least $1,000,000 is to be spent on actual drilling before the June 21, 1958, deadline, according to the Jamaican minister of agriculture and lands.

After that date, Stanolind is required to abandon all interest in half the island. Under certain conditions, it will retain an interest for 2 more years in the preferred half chosen on the basis of exploration results.

In the reserved half of the island, Stanolind may apply for prospecting licenses on blocks covering 200 sq. miles. On each block, at least one 5,000-ft. hole is to be drilled each year.

If Stanolind chooses to remain beyond 1958, it is obligated to a similar work program on at least five such license areas. This would commit the company to a 2-year drilling program of 25,000 ft. per year.

Jamaican law . . . Jamaica will take 12½ per cent of any oil produced as royalty.

Income tax will be 40 per cent of net profits.

A mining lease covering 36 sq. miles must be taken out when oil is discovered. The lease will be checkerboarded into 9 squares. Four of these squares will belong to the Jamaican Government, which may drill on its own or sell the lease to the highest bidder.

Oil prospects . . . Base Metals encountered promising shows of oil and gas in the first wildcat ever drilled in Jamaica last summer.

The Base Metals 1, near Negril on the western tip of the island, reached total depth of 6,300 ft. A strong gas show was found at 760 ft. There were shows of heavy oil and salt water at 2,700 ft., 3,204 ft., 3,370 ft., and 3,755-73 ft.

The wildcat cut Eocene sediments to 5,800 ft. At total depth it was in green, sandy shale, perhaps of Upper Cretaceous age. The section from 2,700 to 3,450 ft. was said to have sufficient porosity for a good reservoir.

Base Metals lacked the capital to explore its huge concession properly and Stanolind was invited into the deal.

Petrofina Expanding in Angola

• Belgium company to build a 10,000 to 20,000-bbl. daily refinery and to form a tax-exempt exploration firm

THE Belgian company, Cie. Financiere Belge des Petroles (Petrofina), is ready to build a refinery and expand exploration in Angola, Portuguese West Africa.

The way for stepped-up operation was cleared by an agreement between Petrofina and the Portuguese Government.

The first order of business is construction of a 10,000 to 20,000-bbl. daily refinery by Cia. de Combustiveis do Lobito Purfina, a Petrofina subsidiary. Engineering studies have already begun. Contracts are to be let in the near future. The refinery will operate on imported crude as long as local production is inadequate.

A new exploration company will be formed by April 1, Petrofina said, if a third well recently started on the Benfica structure confirms the first two tests. The refinery is to be transferred to this new firm.

Tax exemptions other terms . . . The exploration company will be capitalized at 900 million escudos ($31,500,000), and will be "exempt from all taxes whatsoever."

In return for privileges granted, the Province of Angola will receive 33⅓ per cent of the stock. Petrofina will underwrite another third. Its Do Lobito affiliate will provide 11⅔ per cent. Another 11⅔ per cent will be offered to the general public in Portugal, and the remaining 10 per cent will be subscribed by friendly Portuguese groups.

Petrofina is assured an equal profit split with Angola.

Petrofina's affiliate obtained a 3-year, renewable concession in March 1953. In April 1955, a discovery was made about 14 miles south of Luanda, near Benfica. Initial reports said the well was producing 300 bbl. daily of light, good-quality crude.

Gulf Wildcat Has Show

A wildcat being drilled by Gulf Exploration Co. on the British island of Barbados in the Caribbean Sea has shown "very high gas pressure and distillate" in tests below 10,000 ft., the company reports.

The well, Springvale 1, in the mountainous middle of Barbados, is the fourth test drilled by Gulf since it got its concession in 1950. The grant covers about half the island's 166-sq. mile area.

Two previous wells in other parts of the island had oil and gas shows. British Union Oil Co. last year got a commission on the half of Barbados not held by Gulf.

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Oil Big Argentine Goal

New regime freezing assets of Peron-dominated firms, using them to finance Y.P.F. drive for more crude

UNLESS 171 companies and 239 private citizens in Argentina can erase the taint of Peronism which has been attached to them, all their assets probably will be poured into the hungry maw of Yacimientos Petroliferos Fiscales, the government oil company.

During the past month, the provisional government of Argentina has frozen their assets in what it says is an effort to recover "ill gotten" gains made under the Peron regime.

At least two of the companies involved, Industria Kaiser Argentina and Williams Chemical Co., are backed by United States capital. Unless the companies and individuals can prove that all profits since 1943 were "honestly" obtained, their assets will be used by the government for the development of housing and oil.

It was the inability of Y.P.F. to meet Argentina's domestic oil needs that led to the revolt and deposition of Juan Peron, the country's dictatorial president. Peron had other troubles, but his attempt to push through parliament an oil development contract with Standard Oil Co. of California helped spark the revolt that led to his banishment *(The Oil and Gas Journal, September 26, 1955, page 140)*. Peron finally came to the conclusion that foreign capital must be allowed to develop Argentina's oil. His opposition charged him with selling out the country.

Peron's successor, Gen. Eduardo Lonardi, announced immediately that the contract would not be ratified, but he, too, has been deposed. It was the regime of Maj. Gen. Pedro Eugenio Aramburu which seized the private assets last month.

In the days immediately following Peron's ouster, Dr. Raul Prebisch submitted an economic study to Gen. Lonardi in which he called attention to the urgency of Argentina's oil needs. He said the development of oil resources "has not been given the strong stimulus that was essentially needed."

"Foreign capital has been the subject of controversies," Dr. Prebisch conceded, "and it is desirable that its role should be made clear to public opinion. If we are to emerge rapidly from the present crisis in our development, private loans and investments from abroad are needed.

"If there is no desire to accept them, the country must be content to continue indefinitely in its present precarious position. These are the facts and they cannot be ignored."

It has been generally conceded that one of the prime difficulties facing Y.P.F. in its faltering efforts to produce enough oil to meet the country's needs has always been the lack of capital. It now appears that the present government of Argentina is acting to give Y.P.F. at least some capital at the expense of all those suspected of having received an economic smile from the deposed Peron.

Licenses Granted

Big concessions in Libya won by Texaco, Socal

TEXACO OVERSEAS PETROLEUM CO. (The Texas Co.), and California Asiatic Oil Co. (Standard Oil Co. of California), have each been granted one-half undivided interests in six concessions covering 14,200,000 acres in Libya.

Three of the concessions are in Cyrenaica and three are in Tripolitania. This acreage brings the total granted since the passage of the new Libyan oil law to 65,640,000 acres.

Six companies have previously been given exploration acreage. They include Esso Standard of Libya (Jersey Standard), Cie. Francaise Des Petroles, Libyan American Oil Co. (Texas Gulf Producing), Amerada Petroleum Corp. of Libya, Continental Oil Co. of Libya, and Oasis Oil Co. (Ohio Oil Co.) *(The Oil and Gas Journal, December 12, page 80)*.

Geological and geophysical work has been conducted in Libya for the past 2 years by American Overseas Petroleum, Ltd. (Caltex), jointly owned by Texaco and Socal. The country's new petroleum law requires a company to begin operations within 8 months after a concession is granted.

Gulf Shuts Down Wildcat

British Honduras Gulf Oil Co., wholly-owned subsidiary of Gulf Oil, has shut down drilling operations on its wildcat in British Honduras because of a fishing job below 6,100 ft.

Santa Fe Overseas Drilling Co. crews have been trying to retrieve tools caught in the hole for the past 3 weeks.

The test, in the Yalbac area 65 miles west of Belize, was spudded in June 1955 after more than 3 years of Gulf exploration work in the 12,000-sq.-mile Central American country. Gulf has the concession for the entire country.

Union May Buy Foreign Crude

Another large West Coast company is feeling the pinch of being unable to get enough local crude to meet expanding market demands.

Union Oil Co., which previously has turned down all offers of foreign crude, has opened preliminary talks with Gulf Oil Co. for purchase of 10,000 bbl. daily of Venezuelan crude.

Union's controlled production in California falls about 150,000 bbl. short of its West Coast refining capacity. According to latest available statistics, Union companies produce slightly over 100,000 bbl. daily in California. The company's refining capacity is about 270,000 bbl. daily.

Russia Ups Output

1955 daily oil production is almost 1,400,000 bbl.

THE Soviet Government claims its oil production gained about 80,000,000 bbl. (about 219,000 bbl. daily) during 1955, but it apparently fell short of the goal set for the latest 5-year plan.

The end of the year just past marked the close of Russia's fifth 5-year plan. The oil production goal for the end of that plan was 70,000,000 tons, or about 1,400,000 bbl. daily.

A. Yevseyenko, Soviet oil minister, told the Supreme Soviet during its 1956 budgetary sessions that the country produced 11,000,000 tons (80,000,000 bbl.) more oil in 1955 than it did in 1954. The minister added that the increase was "carried out ahead of schedule."

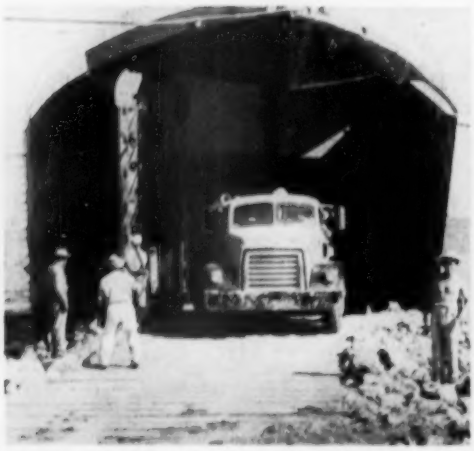
The Russians have released only occasional statements about their production and, based on these statements, Western observers have estimated the Soviet production for 1954 at 58,000,000 tons, or about 1,160,000 bbl. daily. If this estimate is correct, the additional 11,000,000 tons which the Russians claim for 1955 leaves them just a million tons, or almost 25,000 bbl. daily, shy of their production goal.

In his short address to the Russian parliament, the Soviet oil minister said new producing centers have been developed in the Ural Mountains and along the Volga River. He said production in the new districts "has more than trebled in the past 5 years."

BULK OF REFINERY EQUIPMENT moved entirely by water from Zorritos oil field on the north coast of Peru to Iquitos, near the headwaters of the Amazon River.

THE LANDING SHIP CHIMBOTE, a ship of 1,300-ton capacity, was used for the all-water haul. It is shown here on the beach at Zorritos, after the landing operation.

Refinery Moves Around Top of Continent



TWENTY-TON TRUCK leaving LSM Chimbote through the gate door.

ROADS AND PLATFORM areas were carved out of jungle at Iquitos.

To Reach Its New Jungle Location

by Herbert C. Fries

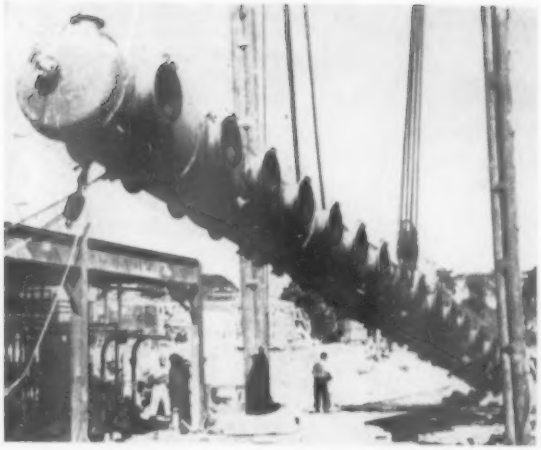
AN OIL refinery is being built in the heart of the South American jungle on the Peruvian Amazon near the town of Iquitos. The refinery area, carved out of virgin forest, is the first of several industrial sites to be cleared in this general area.

The equipment for the refinery was obtained from Refineria Villar, located near the Zorritos oil field on the north coast of Peru. This plant was dismantled in late 1953 by crews of Empresa Petrolera Fiscal, the government company.

Author is general superintendent of refining for Empresa Petrolera Fiscal, Lima, Peru.

Refinery journey . . . Early in 1954, the LSM Chimbote—a ship of 1,300-tons capacity—moved into Zorritos beach to receive the cargo. The columns, boilers, pipes, and other materials were moved into the craft through the double-doored gates of the prow by means of low-bed trucks and trailers.

The load was completed in less than a week. The ship sailed northward through the Pacific Ocean, through the Panama Canal, across the Caribbean Sea, and past the Atlantic to arrive at



BUBBLE TOWER is lifted into place at Iquitos.

TOPPING PLANT as viewed from TEL mixing plant.

the delta of the Amazon River. It then moved 6,700 miles up the Amazon nearly to the head waters.

The water route was the long way around, but it had to be used because of the impossibility of transporting the heavy equipment over the Peruvian Andes. Lighter equipment was shipped by truck from Lima to Pucallpa and from there by light river craft down the Ucayali River to Iquitos.

Site work . . . While the equipment was enroute, a camp was erected on the new location and paths through the jungle were cut out for the topographic survey. The area was cleared and tractors began to prepare the site for foundations. Provisional storehouses were erected to receive materials, and two loading platforms were prepared. The ship arrived after 40 days in transit and unloading began.

This stage of the work proved exceedingly difficult because of soil conditions, the tremendous rainfall, and the swell of river water.

Construction . . . The next step was the extension and completion of the platforms within the refinery area. The total volume of earth moved by the tractors was about 650,000 cu. yd. This work was seriously impaired during the rainy period.

The different plants and buildings were located within the area according to the refinery plan. Soil resistivities were calculated and bases for 15 storage production tanks of 500 to 5,500-bbl. capacity were constructed. Major foundation work was required also for the distillation unit, power house, and transfer pump house. Nearly all plant foundations were made of reinforced concrete of sand and cement mixture without stone. There are no sources of suitable stone nearby.

Concrete tiles were made to protect tank bottoms against the acidity and dampness of the soil. Because of the heavy weight of the distillation unit, a conventional cement mixture was employed in making the base for this column. Brick rubbish was used as filler in preparing the foundations of other buildings. In all foundation work, special attention was paid to soil preparation.

A drainage system was extended through the whole area for protection against rain water and to prevent the soil from slipping. The river bank was reinforced by pilings in several spots for the same reason. The river level fluctuates some 40 ft. during the course of a year.

A number of roads had to be built to supply the construction area with materials. The only materials available in the region are sand, bricks, and wood. Others had to be brought in by launch. Transportation at the building site was by tractor-drawn wooden skids.

These are the various refinery buildings which were constructed: main office, laboratory, warehouse, and work shops.

Processing . . . The topping unit is the center of the refinery operations. This unit, with a capacity of 1,500 bbl. per day, will produce straight-run gasoline, kerosine, diesel oil, and bunker fuel. Paraffin-base crude oil will be supplied by Compania Petrolera Ganso Azul, which has production in Aguas Calientes field near Pucallpa on the Ucayali River.

A modern ethyl-blending plant has been built to improve the low-octane, straight-run gasoline.

Distillation products will be stored in rundown tanks and from there pumped to storage tanks by means of transfer pumps. These pumps will also be used to load tankers and to receive crude oil. A floating pier will be constructed for mooring tankers and light river craft.

Water treatment . . . Water for drinking and industrial use will be pumped from the pier platform by vertical centrifugal pumps. It will first pass through sedimentation tanks for treatment with flocculents. The river water usually contains large amounts of solid and colloid substances. Potable water will receive additional filtering and chlorination treatment.

When refinery construction is finished, additional projects are planned, including an electric plant to provide the town of Iquitos with power. This plant will be fired with bunker fuel from the refinery. Later on, a lube-oil plant may be installed.

The project area is divided into industrial and residential zones. In 1956, these installations will be completed: housing for the refinery personnel and their families, a restaurant, shopping center, and a club.

Other activities . . . A modern service center, a novelty for Iquitos, is now under construction. It will provide river craft and motor vehicles with four different types of fuels and a complete line of lubricants.

Other industrial installations in the Iquitos area are the naval base Santa Clotide and the Astoria Importing & Manufacturing, Ltd., sawmill. These two installations and the refinery will soon be connected by a highway.

The new refinery will not only contribute to further industrialization by production of fuels, but will also stimulate future development by a program of investigation of natural resources of the territory.

Technical-chemical studies and pilot-plant tests will be conducted to aid in this program

Editors' Note . . .

A new approach to solving common problems . . .

This is a progress report on a research project of vital concern to all operators of gas compressors—control of pulsations. The report details work of the Pulsation Research Council of Southern Gas Association, as performed by Southwest Research Institute. It reflects work and thinking of outstanding people who use and build gas compressors as well as the skills and knowledge of topflight experts.

This project in itself is a new approach in solving common problems by the use of outside research groups. Sixteen gas companies and four major compressor manufacturers, all members of the S.G.A., formed a Pulsation Research Council within S.G.A. in an attempt to solve the problems which have been with the industry for many years. This group provided its own funds separate and apart from other S.G.A. funds. Only the companies in the Research Council participated in the project.

A steering committee was appointed to supervise the project and work with Sw.R.I. The manner in which the actual research work was done was also a new and different approach. All pertinent information and work done by the compressor manufacturer and operating companies was pooled for the benefit of Sw.R.I. personnel. The steering committee worked closely with Sw.R.I. in setting goals, evaluating results, and in having portions of the actual research work performed by member companies. Therefore, this project has had the direct benefit of the thinking and work of outstanding people with compressor manufacturers and operating companies as well as topflight research people from Sw.R.I. during all phases of the project.

In discussing this article with the authors we asked if the analog could be applied to surge problems on liquid pipelines. They stated that the design methods for the analog of liquid piping are identical and the compressor analog is just as applicable to a reciprocating liquid pump.

The Research Council desires that other companies benefit from this program and states:

"Now that the project has progressed to the point where we are doing practical work, the Research Council desires to make this information and these facilities available to any other companies which might be interested. We have announced in S.G.A. and A.G.A. bulletins that oil and gas operating companies can become members of this group. In addition, we also want to make membership in the project available to other industries such as the chemical industry and engineering and manufacturing companies. We are in the process of making such arrangements." Anyone interested can obtain information by writing Edward N. Henderson, P. O. Box 1734, Shreveport, La.

The following is a list of participating companies at the present time:

Arkansas Louisiana Gas Co., El Paso Natural Gas Co., Lone Star Gas Co., Northern Natural Gas Co., Oklahoma Natural Gas Co., Pioneer Gas Co., Phillips Petroleum Co.

Southern Natural Gas Co., Southern Union Gas Co., Tennessee Gas Transmission Co., Texas Eastern Transmission Corp., Texas Gas Transmission Corp., Texas Illinois Natural Gas Pipeline Co., Transcontinental Gas Pipe Line Corp.

Trunkline Gas Co., United Gas Pipe Line Co., Clark Bros. Co., Inc., Cooper-Bessemer Corp., Ingersoll-Rand Co., Worthington Corp.

The S.G.A. steering committee is composed of the following members:

Edward N. Henderson, chairman, Arkansas Louisiana Gas Co.

O. H. Moore, vice chairman, Tennessee Gas Transmission Co.

M. M. Heller, United Gas Pipe Line Co.

B. E. Perry, Cooper-Bessemer Corp.

Tom Pofahl, El Paso Natural Gas Co.

Advisors to the steering committee:

R. C. Bain, Arkansas Louisiana Gas Co.

Glenn Damewood, El Paso Natural Gas Co. (Now with Sw.R.I.).

F. M. McNall, Clark Bros. Co., Inc.

Tom Novasad, Tennessee Gas Transmission Co.

The following Sw.R.I. personnel were responsible for over-all supervision or supervision of some particular phase of the project:

Dr. James M. Sharp, Dr. Paul M. Erlandson, Dr. J. Victor Hughes, Dr. C. A. Culver, Dr. C. D. Janney, and Dr. R. B. Grant.

Report: Compressor Piping Design for

by James M. Sharp*

and

Edward N. Henderson†

PART 1

AN intensive research program on pulsation control in gas pipelines has been carried out over the past 3 years by the Pulsation Research Council of the Southern Gas Association. An electrical analog computer was developed by Southwest Research Institute as part of the research program. It has been used to design and test piping at 12 compressor stations and to evaluate performance of piping designed by other methods. In all cases the analog method proved superior to theoretical methods commonly used today. Results show that the use of the analog computer is the most advanced, efficient, economical, and rapid way to design compressor piping for pulsation control and maximum compressor efficiency.

Other methods now in use, such as the "Cutoff" formula and the "Cos W" method, are not capable of predicting completely the performance of piping as pulsation dampeners. These other methods do not evaluate the effect of piping on compressor loading and volumetric efficiency.

In contrast, the electrical analog allows complete evaluation of compressor performance with various piping configurations, loads, compression ratios, and speeds. It also will show just what happens within the piping as regards standing waves, resonant points, etc. Of course the analog model won't design a piping system. But measurements from it clearly show the nature of any difficulties and their location in the system. This allows use of sound engineering principles to get desired operation from the completed installation.

This, then, is the first of two articles on design of compressor piping so as to control pulsations and, at the same time, permit maximum efficiency of the compressor. This first article discusses advantages and limitations of design methods most commonly used. The limitations, as presented, are based on a study which included theoretical evaluation of design methods in use, field tests of stations having piping designed by these methods, and anal-

*Chairman, physics department, Southwest Research Institute, and †chief engineer, Arkansas Louisiana Gas Co.

Pulsation Control and Maximum Compressor Efficiency

Here are results of a 20-company research project into problems of pulsation control. This report shows use of an electrical analog to be the only way to adequately design compressor piping for maximum pulsation control and compressor efficiency by allowing complete prediction of the effect of piping on compressors before installation. No theoretical method will do this and the reasons why are given in this article. The second part, to follow next week, shows how the analog is used in piping design.

ysis of results of these methods made with an electrical analog of a compressor installation.

The second article will describe the analog computer developed by Sw.R.I. for S.G.A., give types of data obtainable from it, and show how the analog data are used to design compressor piping.

Review of Methods of Pulsation Dampener Design

Three procedures for designing pulsation dampeners have been developed from fundamental acoustic theory. In the development of each procedure, assumptions have been made to reduce the theory to formulas for use in engineering practice. In the three methods presented here, the assumptions made have been progressively fewer in each case. As a result, each method is more exact and the formulas developed more complex than for the preceding method. Yet even the most exact method is useful only for computing the transmission characteristics of a conventional low-pass filter. Similar formulas exist for computing transmission through band-pass and high-pass filters. However, even combinations of these formulas are inadequate for the design of filter systems involving a combination of several basic types.

This article primarily points out the limitations of the formulas used in each of the three methods. These limitations were determined by a theoretical evaluation of each assumption and its implications, and by evaluating the importance of each assumption from a study of field test data and data obtained from electrical analogs of 12 actual compressor installations. The two least complex methods—the use of the "cutoff frequency formula" and the "Cos W method"—are in common use in the gas pipeline industry. These design methods are concerned solely with prevention of transmission of compressor pulsations to the station headers. They do not provide a means of preventing or controlling pulsations in the suction and discharge piping of the compressor nor do they provide a means of preventing cylinder overload or improving compressor efficiency since they cannot treat the compressor as part of the design process.

The equations from each of the three methods are of value in the design of compressor piping. However, each method and its formulas must be used with discretion and with a complete knowledge of its limitations.

Relative advantages and disadvantages of these methods are summarized as follows and details will be given later. The pressure-transmission curves computed by each method for a double expansion-chamber dampener are shown in Fig. 1.

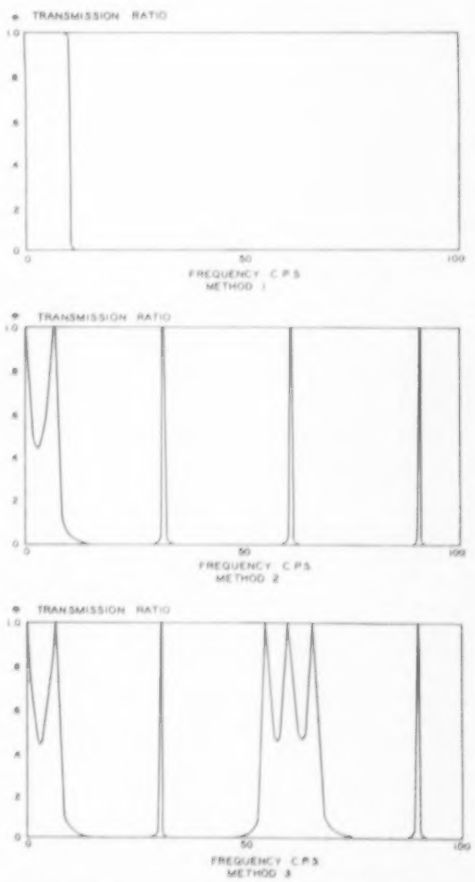
Method 1. The "Cutoff Frequency Formula"

Advantages:

1. Simplicity.
2. Permits rapid computation of the lowest frequency at which significant damping begins.
3. Permits rapid determination of pipe size necessary to cause damping at a specified low frequency.

Disadvantages:

1. The low-frequency cutoff is usual-



FREQUENCY TRANSMISSION CURVES for the same filter as calculated by the three methods discussed in this article. Fig. 1.

ly defined as the frequency above which more than 90 per cent damping (less than 10 per cent transmission) occurs. This method permits no determination of the amount of damping and, in terms of this definition of cutoff, may result in computation of a cutoff in error by as much as 1,000 per cent.

2. Ignores the form factor of the surge volume* and the relative diameters of the volume and choke. Causes erroneous conclusions regarding the damping characteristics of the compressor piping.
3. Ignores the existence of pipe resonances and standing waves. Completely fails to predict pass bands above and below cutoff frequency which are always present.
4. Leads to indiscriminate use of surge volume, choke diameter, and choke length to achieve a desired cutoff without consideration of resulting resonance effects and effects on compressor loading and efficiency.

Method 2. The "Cos W" Criteria

Advantages:

1. Reasonably simple to use.
2. Permits determination of low-frequency cutoff and indicates frequency of the major pass bands above cutoff.
3. Permits determination of pipe sizes to provide damping of pulsations in specified frequency bands (usually specified as the harmonics of the fundamental compressor frequency). Computations are simple and can be made with nomographs.

Disadvantages:

1. Does not permit computation of **amount** of damping in any frequency band. Thus, cutoff frequencies for all pass bands may be in error by a large per cent.
2. Prediction of pass bands above the low-frequency cutoff is in error for piping configurations other than straight lengths joined end-to-end and for piping configurations wherein corresponding pipe lengths (e.g., lengths of two bottles) are not the same.
3. Same as 2 and 4 for Method 1.

Method 3. Plane Wave Theory

Advantages:

1. Predicts frequency limits of all pass bands accurately.
2. Predicts the amount of damping in any frequency band more accurately than Methods 1 and 2.
3. Method applies to any piping configuration.

Disadvantages:

1. A separate formula must be derived for each piping configuration. Specially trained personnel are required and the process is tedious and time consuming. Computations are prohibitive for other than fairly simple configurations.
2. Does not include viscous damping. Thus computations of amount of damping are in error by the amount of viscous losses.

General Limitations of All Three Methods

1. All three methods are "cut and try" methods in that computations must be made for several combinations of pipe sizes and piping configurations to achieve desired damping characteristics.

2. Each method assumes pulsations are generated at a single point and computes on the basis, whereas a compressor may introduce pulsations into the piping at several points (nozzles).

3. Each method assumes the dampener is an isolated set of pipes and provides no means for considering effects of reflections back into the filter from compressor nozzles, valves, and headers.

4. The computation of a damping curve (P_R or frequency response curve) is the only information attainable with any of the methods. Such a curve is merely a plot of the ratio of the pressure amplitudes for each frequency at the input and output sides of the dampener. Actually the "input and output" have meaning only when the dampener has a very long straight pipe at each end; since this is never true in the actual case, the meaning of the computed damping curve is difficult to specify.

5. Only Method 3 takes into account the two most important criteria which determine the amount of damping at a given frequency (area ratio and the number of dampener sections) and it fails to account for viscous damping.

6. Only Method 3 is valid for other than end-to-end junctions of straight pipes. Its complexity for other configurations is too great for practical use.

7. None of these methods gives information about the effect of the piping on compressor efficiency and cylinder loading.

Frequency-response curves as computed by all three methods are shown in Fig. 1. These curves are for a symmetrical double-expansion chamber pulsation dampener consisting of two surge volumes 14 ft. long by 26 in. in diameter separated by a choke 28 ft. long and 8 in. diameter.

Basic Design Requirements

The purpose of a pulsation dampener is to convert intermittent flow into a smooth, steady flow. Since the intermittent flow and the accompanying pressure pulses originating from gas compressors, internal-combustion engines, and the like occur periodically, and since they are transmitted through the compressor piping, intake and exhaust lines, etc., with the speed of sound, the pulsation dampener must consist of an acoustic filter.

The pressure pulses, or sound waves, are not simple sine wave pressures but have a fairly complex wave form, composed of many frequencies. The frequency spectrum will contain the fundamental frequency of the compressor or engine as determined by crankshaft speed and number and spacing of cylinders. In addition, multiples of this frequency (harmonics) will always be present in varying amounts. When the cylinder clearances are not all identical, at least one submultiple of this frequency (subharmonic) will be present.

Each crankshaft speed generates its own particular fundamental and harmonic acoustic frequencies. Thus, a variation in crankshaft speed from some minimum to some maximum value will cause bands of frequencies to be generated. Above same value of frequency these bands will overlap to such an extent that all frequencies above this value are present.

A pulsation dampener is therefore an acoustic filter designed for minimum transmission of all the frequencies generated as compressor or engine speed varies from minimum to maximum. Since the transmission of all frequencies other than zero cannot be prevented, and since steady flow (zero frequency) must be transmitted with minimum attenuation (minimum pressure drop), the basic filter must be a low-pass filter. That is, it must transmit with little reduction in pressure all frequencies from zero up to some cutoff frequency. An ideal filter would transmit none of the frequencies above this cutoff frequency.

Of course, a 100 per cent attenuation of any frequency low enough to be important is unattainable in practice. Further, the reactive impedances which provide the filtering action are not single lumped impedances, but are distributed over the entire length of any section of the filter. So the filter will not only fail to provide high attenuation of some of the frequencies above the cutoff, but will transmit them completely undamped except for the damping resulting from viscous losses. A low-pass filter, then, has "pass bands"

*Surge volume as used herein has the same meaning as expansion chamber or bottle.

which show up as frequency bands of high transmission in a pressure transmission ratio or frequency response curve. These pass bands begin appearing at a frequency where the length of one, or a combination of filter components is about one-half the wave length of sound at that frequency. In gas-pipeline compressor installations, these pass bands occur at fairly low frequencies since some piping components may be as long as 50 ft. For this length and a typical sound velocity of 1,400 ft. per second, pass bands would first appear at about 14 cycles per second.

These pass bands above cutoff result from resonance of the filter components. The resonances are fairly broad, and will result when a driving frequency equal to or close to the true resonant frequency is introduced into the resonant component at the right point to support resonance. Therefore, filter designers must accept the fact that each component long enough to resonate within the range of frequencies involved tends to resonate; and, once the dimensions of a filter component are established, special steps must be taken to eliminate resulting pass bands from the frequency-response curve.

In practice, then, a good pulsation dampener must first have a low-frequency cutoff which is below the lowest significant frequency being generated. Second, it must eliminate all pass bands above that cutoff frequency, or must have pass bands which do not coincide with any significant harmonics of the fundamental frequency being generated. Using proper design techniques, a filter which effectively eliminates all the pass bands can be devised; however, such an "absolute" filter may be large and costly. Therefore, it would appear that designing the filter so that pass bands (or filter component resonant frequencies) do not coincide with the **significant** frequencies being generated would be most desirable.

The difficulty in applying this concept arises from the indeterminacy of the relative amplitudes of the frequencies being generated (which change with crankshaft speed, compression ratio, etc.). A significant frequency is one with an amplitude large enough to sustain resonance of a filter component when it coincides closely with the component resonant frequency. Unfortunately, the viscous damping in a typical filter component is so small that very little amplitude is required to not only sustain resonance but to create a very damaging amplitude at the resonant frequency.

Because of this indeterminacy of what constitutes a significant frequency, design of a filter on the basis that pass bands will not coincide with certain of the frequencies being generated is frequently inadequate. The only means of establishing that a dampener design is satisfactory are: (1) to install the dampener on the compressor for which it is designed and subject it to performance tests; or (2) to use an electrical analog or model of both the compressor and filters to predict performance over a wide range of operating conditions.

Origin of Design Methods

Many attempts have been made to design low-pass acoustic filters which have the desired frequency-transmission characteristics of a pulsation dampener for pipeline compressors. The performance of these filters has been largely unpredictable and results have been erratic.

The design of most of the well-known types of dampeners has been based on the acoustical theory presented by G. W. Stewart and R. B. Lindsay in various technical papers* from 1922 to 1938 and in a textbook† published in 1930. In its most complex form, the theory of Stewart and Lindsay regarding the transmission of sound in gas-filled tubes and the design of acoustic filters is quite adequate for filter design; however, because of its complexity, this theory does not lend itself to rapid solution of filter-design problems. In fact, practical use of the complete theory requires an electronic computer for rapid solution of equations.

Because of the complexity of a complete acoustical treatment of filters, as presented by Stewart and Lindsay, a number of approximate methods have evolved. These design procedures have been used which are successively more complex and successively more reliable. The first two methods were presented by Stewart and Lindsay directly; the third was originally used by the National Advisory Committee for Aeronautics laboratories in studying muffler designs.

These three most significant basic methods of pulsation-dampener design are presented here in order to point out the capabilities and limitations of each and to outline the trends in the design of dampeners over the past 30 years or so. These three methods are not the only ones in use; other methods based on experimental results have been used; but such methods could only be analyzed on an individual basis.

Cause of dampener vibration . . . What constitutes "successful" performance of a pulsation dampener? It is probable that many excellent designs have been condemned through a lack of understanding of what an acoustic filter can be expected to do. Specifically, the filter selectively transmits certain frequencies and attenuates or prevents transmission of all other frequencies. For this to be done, the energy associated with the frequencies to be attenuated must be alternately stored within and released from the filter in such a manner that the output from the filter is smooth and steady. In the case of an effective pipeline-compressor dampener, tremendous amounts of energy are undergoing this alternate storage and release. Hence, the dampener is subject to very large forces, and if these forces were unbalanced, significant vibration of the dampener itself could result. Design means are available to minimize this possibility but will not be discussed here.

Basic Assumptions Common to the Three Methods

Since the design methods to be described are all derived from the acoustic theory of Stewart and Lindsay, certain assumptions are common to all. Among these assumptions are the important considerations: (1) that plane wave theory applies to the problem of sound transmission through piping networks; (2) that there are no discontinuities of pressure or volume velocity at any cross-section in the piping; and (3) that the filter is terminated at each end so that sound is not reflected back into the filter.

The validity of the first two of these assumptions has been amply verified by experiment. The third assumption leads to many difficulties since the condition described is never achieved in a practical pulsation dampener. The assumption is necessary, however, if there is to be any common basis for describing filter performance and if there is to exist any reasonable definition of pressure transmission ratio or frequency response of an acoustic filter.

In addition, all three methods neglect the effect of viscous damping. This is not a basic assumption, but rather an approximation which is reasonable and necessary when the mathematics is to be handled with even a reasonable degree of simplicity. Actually, viscous damping of the sound waves in a dampener is predictable with a fair degree of accuracy; but it can be neglected without unduly affecting computed performance for all filters except those using resistive damping. Since selective damping can be accomplished in most cases by other means, the resistive type of filter is seldom used because of the associated pressure drop and reduced station efficiency.

*G. W. Stewart, "Acoustic Wave Filters," Phys. Rev., 20, 528, December 1922. G. W. Stewart, "Acoustic Filters in Series," Rev. Sci. Inst., 9, 583, November 1924. R. B. Lindsay, "The Filtration of Sound, 1," J. Appl. Phys., 9, 612, October 1938.

†G. W. Stewart and R. B. Lindsay, Acoustics, D. Van Nostrand, Inc., 1930.

The "Cutoff Frequency Formula"

The first method of pulsation dampener design to be generally used in the industry is that proposed by Stewart in his first paper on acoustic filters published in 1922. In this paper, Stewart developed sets of formulas for the cutoff frequencies of low-pass acoustics filters, each based on a slightly different assumption.

One set of equations corresponded to conditions to be expected in a dampener composed of one or more expansion bottles and a small-diameter (relative to the diameter of the main flow conduit) choke tube in the flow line. As presented by Stewart, these equations, which determined the frequency limits between which there was no attenuation for a low-pass filter, were:

$$F_1 = 0,\ F_2 = (1/\pi)\ (1/M_1C_2)^{1/2} \quad (1)$$

where F_1 is the low-frequency limit of the pass band, F_2 is the high-frequency limit (cutoff) of the pass band, M_1 is the acoustic inertance of the choke tube, and C_2 is the acoustic capacity of the expansion bottle. Since:

$$M_1 = \rho L_1/S_1 \text{ and } C_2 = V_2/\rho a^2$$

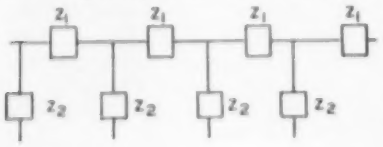
the formula for the cutoff frequency, F_2, may be written as:

$$F_2 = (a/\pi)\ (S_1/L_1V_2)^{1/2} \quad (2)$$

where a is the velocity of sound, S_1 is the cross-sectional area of the choke, L_1 is the length of the choke, and V_2 is the volume of the expansion bottle; ρ, which drops out, is the gas density. Equation 2 then permits a very simple calculation of the cutoff frequency directly from dimensions of the dampener components.

In view of the apparently drastic assumptions made in arriving at this formula, it provides a surprisingly good value for the actual cutoff frequency of a low-pass filter in many cases. However, the prediction of cutoff frequency based on this formula may sometimes be in error by as much as 1,000 per cent. In order to evaluate this method of designing a dampener by choosing L_1, S_1, and V_2, it is necessary to examine the assumptions made in simplifying the theory to the point shown in Equation 2, and the limitations of the general theory itself.

Equation 2 is evolved from the most general condition for any pass band of a filter composed of an infinite number of identical sections, each composed of an impedance Z_1 in series with the flow and a branch impedance Z_2. This configuration is as follows:



These general conditions for no attenuation are $0 \leq (Z_1/-4Z_2) \leq 1$; therefore the solutions of the equations:

$$Z_1/-4Z_2 = 0 \text{ and } Z_1/-4Z_2 = 1 \quad (3)$$

determine the frequency limits of the pass bands of the filter. Equation 2 results from Equation 3 if one assumes that Equation 3 can be applied to a single filter element (one series element Z_1 and one branch element Z_2), that Z_1 has no capacity, that Z_2 has no inertance, and that neither element has resistance. It is obvious that none of these assumptions is correct. However, insofar as determining cutoff frequency is concerned, the approximation is fairly good.

The actual cutoff is not sharp (transmission does not drop abruptly to zero **at the predicted cutoff frequency**) because the single filter element is not as effective as an infinite number of filter elements and because resistance "flattens" the transmission pattern, that is, the filter does not "tune" sharply. The actual single element filter passes more of any given frequency than the infinite filter, but the shapes of the frequency response or transmission ratio curves for the single element and infinite filters are generally the same.

Pass bands not predicted . . . The serious result of using this approximation is not an erroneous prediction of cutoff frequency (which is usually good within 20 or 30 per cent). Rather it is the failure of this modified treatment to predict pass bands above the cutoff frequency. Significant high-frequency pass bands always exist when the length of the choke(s) or bottle(s) in the dampener are of the order of one-half of a wave length or more. And this is normally the case because the low value of cutoff necessary for damping compressor frequencies demands large values of L_1 or V_2 (or such a small value of S_1 that it is usually impractical for the flow rates involved). The pipe sections in a dampener consist acoustically of distributed impedances. Each section and, in some cases, combinations of sections resonate in the same fashion as an organ pipe; these resonant frequencies are usually transmitted with little attenuation through the filter. Further, the usual lengths of bottles, chokes, and laterals are such that the fundamental resonant frequencies often coincide with a low harmonic of the compressor-generated frequency. The result is development of high pulsation levels in the piping at the resonant frequencies.

Although simple means exist for either destroying resonance or preventing the transmission of resonant frequencies, the cutoff formula is of no assistance in either predicting resonant conditions or in eliminating them. When a resonance occurs at a frequency only slightly above the cutoff frequency, the whole effect of cutoff is nullified; this condition is usually very detrimental since the designed cutoff is usually just below the compressor fundamental frequency so that such a resonance would closely coincide with the compressor frequency.

Another less important inaccuracy involved in using Equation 2 is that it applies only to symmetrical filters, that is, those wherein the dimensions of the bottle and choke in the first filter element are identical to those in ensuing elements. This inaccuracy is not too important because (1) the physical size of most pulsation dampener elements is so large that more than two elements are seldom used; (2) when two elements are used, the dimensions of the components usually are comparable; and (3) including additional elements beyond the first helps reduce the cutoff frequency although it may increase transmission in the high-pass bands or create new pass bands when the dimensions of the additional elements are different from the first.

A third criticism of this design method is in the nature of a limitation rather than an error. This method (as well as the Cos W method to be discussed next) yields only qualitative information. It defines the limits of the pass band, but provides neither a measure of how much pulsation is transmitted at the pass-band frequencies nor how little is transmitted at the attenuation-band frequencies. The simplification of the theory by writing the equations in terms of L_1, S_1, and V_2 means that one of two most important factors determining the **amount** of transmission is completely ignored. This factor is the area ratio at the junctions in the filter. The second important factor—the total number of filter elements—cannot be taken into account simply and must be neglected.

In summary, then, Equation 2 provides only a first step in filter design. Even this first step is of questionable value when Equation 2 is the only design criterion available. Therefore, the primary advantage of this design method is that computations are simple.

The Cos W Method

The second design method, usually identified as the Cos W formula, is a more refined treatment and is consequently more tedious. This method was also first presented by Stewart for acoustic filters, but it is based on original work by W. P. Mason on electric wave filters. The main difference between the assumptions made in developing this method and that of Equation 2 is that in this method it is **not** assumed that the wave length is much

larger than the length of the filter elements; therefore, resonance above the cutoff frequency are allowed and are predicted by the theory. The formula which defines the upper and lower limits of all pass bands and which is based on Equation 3 for the infinite filter is:

$$-1 \leq \text{Cos } W \leq +1 \qquad (4)$$

where $\text{Cos } W = \cos kL_1 + (iZ/2Z_b) \sin kL_1 \qquad (5)$

and $k = 2\pi F/a$, $Z = \rho a/S_1$, and $Z_b = -i\rho a^2/2\pi F V_2$

where F is the frequency, a is the velocity of sound, ρ is the density of the gas, S_1 is the area of the choke, L_1 is the length of the choke, V_2 is the volume of the expansion bottle, and i is the complex operator.

Note that Cos W is **not** cosine of W; the designation Cos W bears no relation to the usual trigonometric quantity but is merely a convenient quantity from the standpoint of filter design study. Expressed in terms of the dimensions of the filter components:

$$\text{Cos } W = \cos 2\pi F L_1/a - (\pi F V_2/aS_1) \sin 2\pi F L_1/a \qquad (6)$$

Equation 6 can be used to plot Cos W for a filter, and the frequency limits of the pass bands can be determined from Equation 4. This procedure is tedious since many combinations of L_1, S_1, and V_2 must be tried for a range of values of a to arrive at a filter which passes only the desired bands of frequency. However, the amount of work required is not prohibitive and it can be greatly simplified by use of nomograms.

This method, as was the case using Equation 2, will usually predict the low cutoff frequency satisfactorily, but has serious inaccuracies in predicting the location and width of the high-frequency pass bands. This is not surprising since Equation 6 is based on a filter with an infinite number of identical sections; whereas the actual filter usually has no more than two sections and these are frequently not identical. Once the filter is designed with the use of Equations 4 and 6, a transmission ratio curve can be plotted from the formula:

$$P_R = \left[1 - \frac{Z^2}{|Z_b|^2}\text{Cos}^2 W\right] - 1$$

$$= \left[1 - \frac{4\pi^2 F^2 V_2^2}{a^2 S_1^2}\text{Cos}^2 W\right] - 1$$

This formula has the same type of inaccuracies as Equation 6 since it assumes a filter having two expansion bottles separated by a choke; whereas the basic theory assumes an infinite filter. Also, neither Equation 4 nor Equation 7 is correct if the filter has viscous resistance.

The serious objection to this method of design is that it fails completely to predict the correct transmission ratio unless the bottles and chokes are joined only at the ends. Equation 7 fails completely to handle any other case. Therefore, except for a symmetrical double-expansion-chamber filter with elements joined end to end, Equation 7 is useless except for predicting the low cutoff frequency and, as discussed previously, Equation 2 may be used.

The N.A.C.A. Method

A third method of pulsation dampener design, developed by the N.A.C.A. laboratories, is completely general except that it assumes perfect (nonreflective) termination at each end of the filter. The method is actually an application of plane-wave theory for sound transmission in jointed conduits as presented by Stewart and Lindsay.

Essentially, the equations are based on the continuity of pressure and volume velocity across a junction; this condition permits writing a series of simultaneous equations which can be solved for the ratio of the pressure amplitudes of the input and output of the filter (P_R). Since one simultaneous equation for both pressure and velocity must be written for each junction between large and small-diameter pipes, this method becomes tedious for a multisection filter. For a **symmetrical** double-expansion-chamber filter, the transmission ratio is given by:

$$P_R = \frac{1}{16m^2}[4m(m+1)^2 \cos k(L_e + L_c) - 4m(m-1)^2 \cos k(L_e - L_c)] + \frac{i}{16m^2}[2(m^2+1)(m+1)^2 \sin 2k(L_e + L_c) - 2(m^2+1)(m-1)^2 \sin 2k(L_e - L_c) - 4(m^2-1)^2 \sin 2kL_c] \qquad (8)$$

where m = area ratio at the bottle-choke junctions (all must be the same for Equation 8), L_e = length of expansion bottle, L_c = length of choke, $k = 2\pi F/a$.

Except that viscous damping is neglected, this formula is exact; that is, it accurately predicts the location of the pass bands, but predicts a per cent transmission that is too high by the amount of reduction caused by viscous damping.

The objection to this method is that a new formula must be developed for each new configuration by solving a set of simultaneous equations. The resulting formula is still lengthy and tedious to handle for a large number of values of L_e, L_c, and m and for ranges of values of a and F (which are included in k).

As an example of the complexity of equations for filters other than those of the very simplest configurations, the P_R equation for a double-expansion-chamber filter having different expansion ratios at all junctions and different lengths and diameters for the two chambers becomes:

$$P_R = \frac{Q_1^{-1} - (M_4 Q_2)^{-1}}{Q_3 Q_6^{-1} - Q_5 Q_7^{-1}} \qquad (9)$$

where

$$Q_1 = K_1 K_3 K_8 [\cos k(-L - L_c - L_1) + i \sin k(-L - L_c - L_1)]$$
$$- K_2 K_3 K_8 [\cos k(L_e - L - L_1) + i \sin k(L_e - L - L_1)]$$
$$- K_1 K_4 K_8 [\cos k(L + L_e - L_1) + i \sin k(L + L_e - L_1)]$$
$$- K_3 K_4 K_8 [\cos k(L - L_e - L_1) + i \sin k(L - L_e - L_1)]$$
$$- K_1 K_4 K_6 [\cos k(L_1 - L_e - L) + i \sin k(L_1 - L_e - L)]$$
$$+ K_2 K_4 K_5 [\cos k(L_e + L_1 - L) + i \sin k(L_e + L_1 - L)]$$
$$- K_1 K_3 K_5 [\cos k(L + L_e + L_1) + i \sin k(L + L_e + L_1)]$$
$$- K_2 K_3 K_6 [\cos k(L - L_e - L_1) + i \sin k(L - L_e - L_1)]$$

and Q_2 through Q_6 are of the same form and complexity, the quantities K_1 through K_8 and M_1 through M_4 are defined by:

$K_1 = (M_2+1)/8$ $K_4 = (1-M_3)/M_3$
$K_2 = (M_2-1)/8$ $K_5 = (M_1+1)/M_1$
$K_3 = (M_3+1)/M_3$ $K_6 = (M_1-1)/M_1$

$M_1 = S_2/S_1$ $M_3 = S_4/S_3$
$M_2 = S_3/S_2$ $M_4 = S_5/S_4$

and:

$k = 2\pi f/a$ = wave length constant
S_1 = cross-section area of inlet tube
S_2 = cross-section area of first expansion chamber
S_3 = cross-section area of choke tube
S_4 = cross-section area of second expansion chamber
S_5 = cross-section area of outlet tube
L = length of choke tube
L_2 = length of first expansion chamber
L_4 = length of second expansion chamber
i = complex operator = $(-1)^{1/2}$

The impracticability of using this equation for a large number of values of the parameters is obvious. Also, it has not been established that an accurate equation for a filter involving tee joints can be written by using this method of developing the P_{II} equations.

Conclusions

Of the three filter-design methods now most widely used, high accuracy can be achieved only by the N.A.C.A. method. And this method requires mathematics which is prohibitively complex, a competent mathematician to develop the equations, and an electronic computer to solve the equations for a wide variety of filter dimensions and speeds of sound. This does not deny that Equations 2 and 6 are "useful." However, they must be used with caution and with a fairly complete knowledge of their limitations.

Fortunately, new methods and techniques of filter design have been developed in the S.G.A.-Sw.R.I. program which permit predictable control and transmission of frequencies above the low cutoff and, when used with discretion, Equation 2 will determine the cutoff.

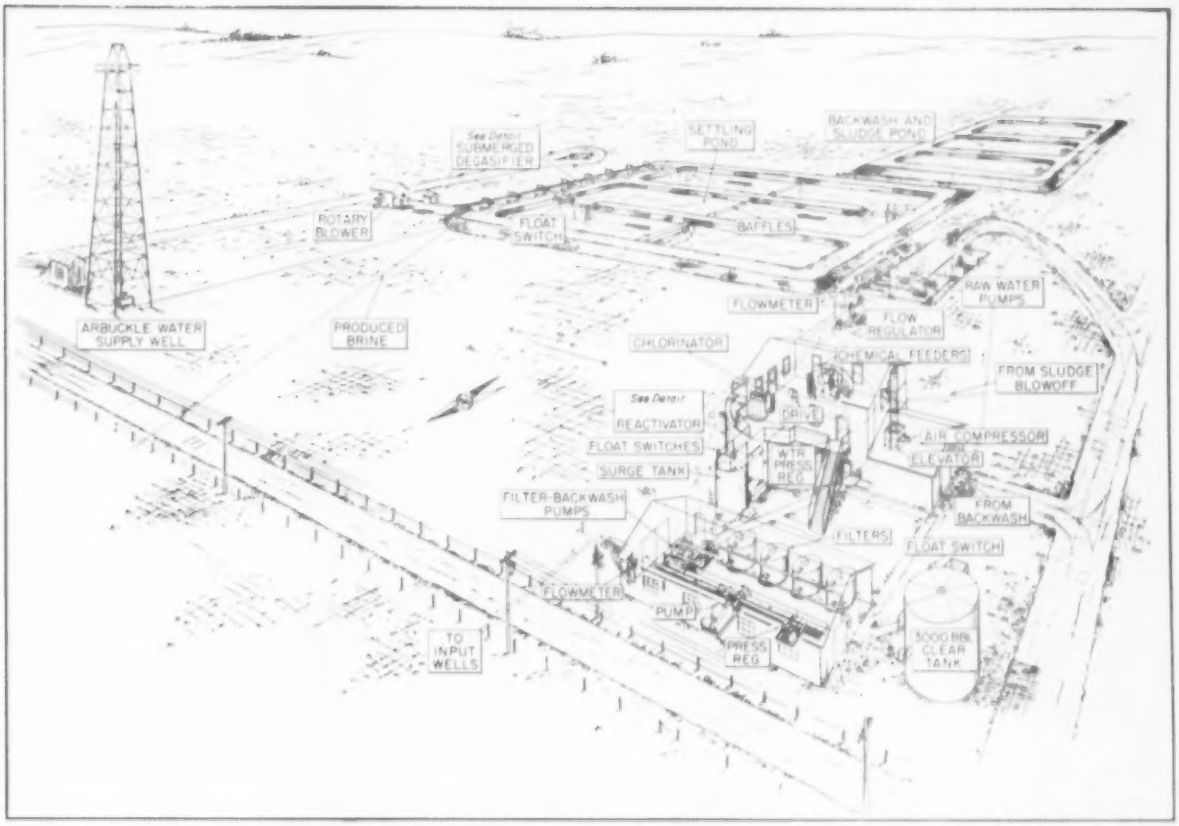
If a completely predictable filter performance were desired or required, the only practical approach would be the use of an analog of the filter which would (1) permit direct measurement of the frequency response (P_{II}), and (2) of equal or greater importance, permit a direct measurement of the distribution and amplitudes of pulsation frequencies at any point in the piping and in the cylinders, and a direct determination of variations in flow and cylinder loading under any combination of crankshaft speed, pocket settings, line pressures, and line temperatures. An electrical analog meeting these requirements is described in Part 2 of this article.

Pipeline Revenues and Throughputs, Third Quarter 1955

(From quarterly reports of pipeline companies to the Interstate Commerce Commission)

Company—	Transportation revenues 1955	Transportation revenues 1954	Per cent change	No. of bbl. of oil originated on line and received from connections 1955	No. of bbl. of oil originated on line and received from connections 1954
American Oil Pipe Line Co.†	$2,102,407	$1,997,949	5.2	$14,157,793	$13,719,123
Arapahoe Pipe Line Co.	1,103,381			7,959,648	
Arkansas Pipe Line Corp.	526,862	540,721	—2.6	3,196,033	3,074,249
Atlantic Pipe Line Co.	2,212,991	2,020,960	9.5	15,843,229	16,838,265
Badger Pipe Line Co.‡	377,865			2,710,342	
Bradford Transit Co.	142,769	154,755	—7.7	956,863	1,344,581
Buckeye Pipe Line Co.	4,081,620	3,658,307	11.6	51,808,487	46,040,703
Buffalo Pipe Line Corp.*	244,125	200,048	22.0	3,259,297	2,783,599
Cherokee Pipe Line Co.	1,288,382	271,572		8,692,745	3,023,089
Cities Service Pipe Line Co.	1,773,405	1,681,674	5.5	20,975,558	20,248,311
Continental Pipe Line Co.†	1,787,756	1,232,411	45.1	19,582,670	15,350,915
Cooperative Refinery Assn.	288,627	266,629	8.3	2,563,844	2,444,918
Crown-Rancho Pipe Line Corp.	202,575	197,670	2.5	1,227,381	1,107,795
Eureka Pipe Line Co.	266,875	308,545	—13.5	614,835	809,950
Freedom-Valvoline Oil Co.	120,277	66,913	79.8	1,753,802	896,319
General Amer. Pipe Line Co.‡	86,629	83,586	3.6	1,510,984	1,416,921
Great Lakes Pipe Line Co.*	8,533,387	8,949,496	—4.7	19,955,474	19,468,518
Gulf Refining Co.	8,984,293	8,039,564	11.8	74,572,946	70,227,446
Humble Pipe Line Co.	9,106,680	8,268,414	10.1	62,362,092	58,403,397
Illinois Pipe Line Co. of Texas	185,444	198,512	—6.6	2,382,691	2,545,358
Interstate Oil Pipe Line Co.	5,046,898	4,726,277	6.8	39,722,119	37,846,206
Kaneb Pipe Line Co.*	298,075	130,589	128.3	2,396,924	1,250,166
Kaw Pipe Line Co.	719,829	718,565	0.2	11,130,738	10,793,545
Keystone Pipe Line Co.*	1,321,362	1,159,204	14.0	10,243,238	8,992,578
Lakehead Pipe Line Co., Inc.	3,548,680	2,802,504	26.6	12,215,621	10,167,620
Magnolia Pipe Line Co.	9,253,395	8,452,391	9.5	42,609,063	42,283,946
Michigan-Ohio Pipeline Corp.†	262,204	228,559	14.7	3,744,391	3,140,673
Mid-Valley Pipeline Co.	3,364,955	3,599,207	—6.5	15,143,196	14,887,191
Nantucket Pipe Line Co.	135,223	141,655	—4.5	781,144	1,092,787
National Transit Co.	424,664	451,990	—6.0	3,442,732	3,756,580
New York Transit Co., Inc.‡	183,196	158,460	15.6	4,949,340	4,391,918
Northern Pipe Line Co.	192,530	165,487	16.3	5,326,848	4,493,402
Ohio Oil Co., Pipe Line Dept.	3,979,164	3,286,024	21.1	46,127,167	40,804,028
Okla. Miss. River Prod. Line, Inc.	782,728	245,125	219.3	3,502,381	2,409,966
Phillips Petroleum Co.*	441,493	410,496	7.6	792,354	729,749
Phillips Pipe Line Co.	6,770,040	6,107,996	10.8	31,259,583	27,174,672
Pioneer Pipe Line Co.	348,206	369,103	—5.7	844,468	920,270
Plains Pipe Line Co.	105,334	355,183	—70.3	1,206,463	3,124,441
Plantation Pipe Line Co.*†	6,617,656	5,877,252	12.6	21,955,836	18,786,290
Platte Pipe Line Co.	2,873,340	3,771,606	—23.8	13,154,305	15,308,370
Portland Pipe Line Corp.	1,388,613	915,759	51.6	17,044,910	11,854,606
Project Five Pipe Line Corp.*	255,385	269,943	—5.4	3,461,430	3,486,807
Pure Transportation Co.	1,299,652	1,286,318	1.0	18,418,764	15,233,032
Salt Lake Pipe Line Co.	2,601,856	2,302,871	13.0	8,545,352	7,391,393
Service Pipe Line Co.	12,940,783	13,277,592	—2.5	40,322,939	41,296,153
Shamrock Oil & Gas Corp.*‡	190,353	151,266	25.8	399,725	318,576
Shell Pipe Line Corp.	7,937,712	7,075,123	12.2	36,184,736	35,181,108
Sinclair Pipe Line Co.	11,590,244	10,092,131	14.8	60,063,208	49,353,173
Socony Mobil Oil Co., Inc.	166,260	176,041	—5.6	3,473,655	3,546,562
Sohio Pipe Line Co.*	1,562,022	1,465,997	6.6	15,474,081	13,750,162
Southeastern Pipe Line Co.*	700,253	693,165	1.0	3,192,890	3,166,939
Sun Pipe Line Co.	3,403,183	3,325,953	2.3	24,590,993	25,066,201
Texaco-Cities Service P. L. Co.	2,466,325	2,114,984	16.6	21,607,980	17,859,659
Texas-New Mexico P. L. Co.‡	2,357,864	2,041,555	15.5	26,038,590	23,497,587
Texas Pipe Line Co.†	9,044,309	7,604,101	18.9	61,583,509	52,689,240
Tidal Pipe Line Co.	154,901	220,287	—29.7	2,710,618	3,501,588
Tide Water Pipe Co., Ltd.§	49,509	32,746	51.2		173,609
Toronto Pipe Line Co.	513,277	491,057	4.5	6,724,096	6,998,857
Triangle Pipeline Co.*	665,278	753,772	—11.7	4,944,523	5,323,184
Tuscarora Pipe Line Co., Ltd.*	471,274	434,217	8.5	2,365,871	2,339,140
Utah Oil Refining Co.	767,454	761,150	0.8	5,124,894	4,939,490
West Texas Gulf Pipe Line Co.	1,701,844	1,630,368	4.4	28,189,015	27,971,826
Wolverine Pipe Line Co.*	665,029	504,986	31.7	3,411,706	2,420,960
Wyco Pipe Line Co.*	587,719	552,978	6.3	1,805,306	1,684,907
Wyoming-Nebraska P. L. Co.	152,918			557,438	
Yellowstone Pipe Line Co.	516,198	183,429	181.4	1,273,443	614,844
Total	$154,235,537	$139,653,188	10.4	$984,144,397	$891,757,458

*Company engaged primarily in handling refined petroleum. †Number of barrels of oil is total delivered out of system. ‡Commenced filing as of first quarter 1955. §Transportation revenue for 1955 represents pipeage on oil previously received into their system, the barrels of which were included in previous reports at time of receipt from connections.



DELAWARE'S PLANT treats brine containing hydrogen sulfide. Special features are the degasifier and reactivator. Fig. 1.

2. Gas, Solids Removal Important In Delaware Plant

by J. L. Eakin

ANOTHER plant which treats produced brine for injection is operated by Delaware Consolidated Oil Co. Fig. 1 is a sketch of this plant showing the equipment and sequence of water-treating operations. Water for flooding comes from a well drilled into the Arbuckle limestone and from produced brine.

Capacity of the plant is about 12,000 bbl. per day. The Arbuckle water well will produce at least 13,000 bbl. per day. Currently, there are 33 wells taking about 4,000 bbl. of brine per day. The flood covers 330 acres of the Bartlesville sand.

Author is petroleum engineer, U. S. Bureau of Mines, Bartlesville, Okla. Material is from USBM R. I. 5134.

Treating problems . . . One of the major treating operations in this plant is the removal of dissolved gases from the injection water. The Arbuckle brine contains from 200 to 500 p.p.m of hydrogen sulfide.

Further treating facilities eliminate solids which might form permanent plugging agents in the injection wells. One serious plugging agent which would be present in the injection water unless removed is iron sulfide. This forms from the reaction of hydrogen sulfide in the Arbuckle brine with dissolved iron in the brine produced from the oil wells. Table 1 shows field water analyses of the supply brine and samples taken at various points in plant.

Degasifier . . . Brine entering the treating plant first passes through a long, baffled trough to remove dissolved hydrocarbon sulfide and carbon dioxide.

The submerged degasifier is a cement trough 6 ft. wide, 6 ft. deep, and 96 ft. long. Each aeration stage is 12 ft. long. The baffles are of ¾-in. marine plywood. An over-and-under baffle causes recirculation of the water in each stage and an underflow baffle permits flow of water between sections.

Perforated plastic pipe jets air into the water in each stage. A 10 by 5-in. rotary blower powered by a 25-hp. electric motor furnishes air at a rate of about 1,000 cu. ft. per minute.

Because of the sulfides in the Arbuckle water and the iron salts in the produced water, large amounts of iron sulfide form when these two streams mix in the degasifier. Occasionally the trough is cleaned through a bottom drain. The plastic jets are not corrodable, but periodically the perforations become clogged and require reaming.

Settling pond . . . Aerated brine flows

TABLE 1—RESULTS OF FIELD WATER ANALYSES, DELAWARE CONSOLIDATED OIL CO. DISTRICT UNIT FLOOD, NOWATA COUNTY, OKLAHOMA

Sample No.	Location of sampling point—	Dissolved gases, p.p.m.			pH	Iron, p.p.m.		Alkalinity as $CaCO_3$, p.p.m.		Super-saturation of carbon-ates as $CaCO_3$, p.p.m.	Residual chlorine, p.p.m.
		Oxygen*	Free carbon dioxide	Hydrogen sulfide		Total	Dissolved	P	M		
1.	Arbuckle supply well	0.5	165	‡204	6.9	0.0	0.0	0	300	46	0.00
2.	Produced brine	No det.	48	0	6.9	17.5	17.3	0	198	20	0.00
3.	Discharge end of degasifier	†1.0	26	11	7.5	0.0	0.0	0	148	54	0.00
4.	Reactivator inlet	0.4	18	0	7.4	6.1	5.1	0	138	43	0.00
5.	Surge-tank outlet	3.3	15	0	7.1	6.5	5.5	0	71	13	0.00
6.	Injection-pump discharge	2.7	21	0	6.9	4.4	4.4	0	79	17	0.03

*Determinations made with dissolved-oxygen meter. †Probably in error because of presence in sample of air bubbles from aerator. ‡Subsequent tests indicated 232 and 450 p.p.m. at supply wellhead.

from the last aerating section of the submerged degasifier to a settling pond, sufficiently large to hold several days' supply. Each compartment of the pond has wooden baffles midway and at the ends of each lane. The baffles have holes drilled near the bottom to keep the water from channeling.

Float switches on the end baffles control the action of the water-supply well pump and the blower. After 80 yd. of travel and sufficient detention time to permit sedimentation, the raw water is drawn from the end of the main pond by centrifugal pumps. These pumps force the water through a flow meter and flow regulator and then into the reactivator.

Reactivator . . . The reactivator, Fig. 2, is constructed from a 41 by 15-ft. steel tank. Capacity is 900 g.p.m. Raw water and chemicals are injected into the uptake tube in the center. Two hopper-type feeders set on top of the tank proportion the chemicals. Flow of the dry chemicals from the feeders into the reactivator is controlled by the flow regulator upstream which turns the feeders on and off every 15 seconds to correspond with the amount of water passed.

Daily chemical treatment is 70 to 90 lb. of chlorine to remove residual hydrogen sulfide, 200 lb. of ferric chloride coalgulant, and 400 lb. of lime which reduces the alkalinity and carbonate supersaturation. Clear water from the field injection line is reduced in pressure to 80 psi. and is used as feed water in the chlorinator and chemical mixers.

In the uptake tube of the reactivator, water and chemicals flow upward in response to a variable-speed agitator. The water then enters the draft tube in which the chemicals and water mix thoroughly.

As the water moves downward in the inverted cone, rate of flow diminishes and the precipitates settle to the bottom of the reactivator. A scraper rotating once each 16 minutes moves the sludge to a central sump. Two valves, actuated every 24 minutes by compressed air, automatically flush the sludge to the waste-water ponds.

Treated water rises to the top of the tank and flows out through collector rings attached to the side of the tank. At this point the water enters a surge tank where approximately 8 qt. of bactericide are added each day.

Water filters . . . Two 1,000-g.p.m. centrifugal pumps pump water from the surge tank through four closed 8 by 10-ft. sand filters and into a 3,000-bbl. clear-water tank. These pumps are also used to backwash the filters about every 3 days. At that time clear water is pumped upward through the filter beds and through a backwash line to the waste-water pond.

Injection system . . . One 6½ by 12-in. duplex pump, powered by a 150-hp. electric motor, pumps clear water to the field distribution system. The pump maintains a maximum pressure of 500 psi. at the plant. Injection capacity is approximately 12,000 bbl. daily.

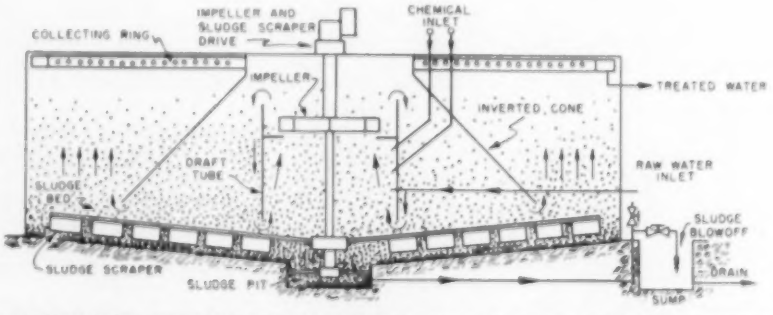
An 8-in. welded steel main line leads from the plant to the field, with a reduction to 6 and 4-in. pipe at distant points. Lines to wells are 2-in. pipe. The entire distribution system is protected from corrosion by magnesium anodes.

Pressure and water-level control . . . Safety devices employed through the system are numerous. A mercury switch on the discharge line of the injection pump will shut down the pump if the pressure gets too high. Also, a shear-pin pressure-relief valve on the high-pressure side of that pump will bypass the water should the mercury switch fail.

Low-level controls in the clear-water tank also will shut off the injection pump. In addition, a low-level control on the clear-water tank turns on the filter pumps and a high-level control turns them off, with an 18-in. interval between controls. Various safety control points have been established by float switches between the clear-water tank, the surge tank, the supply pond, and the supply well and the blower.

A pressure controller installed at the injection pump maintains 500 psi. plant pressure. Some excess water is recirculated from the discharge line to the suction line at all times. The pressure controllers, flow regulator, chlorinator, and dump valve on the reactivator are all operated by compressed air supplied by a small compressor located in the chemical-storage room.

The water-treating plant is equipped with field water-analysis laboratory in which the plant operator makes daily routine tests on samples of water from the clear-water tank and reactivator to determine turbidity, pH, residual chlorine, alkalinity, carbonate supersaturation, and hydrogen sulfide. The alkalinity of the treating solution is also determined regularly.



REACTIVATOR controls the flow of chemically treated water so that complete sedimentation of solids occurs. Fig. 2.

HOW TO READ *FAST*

It's easy to add to your w.p.m. rate. Try it!

by Dr. Nila Banton Smith

Part 2

EVERY businessman should be a rapid reader. In the face of this fact, it is hopeful to know that of all of the facets of the reading process, speed is the easiest one to develop. Here are some of the "secrets."

The rapid reader's eyes move fleetingly across the lines, pausing briefly two or three times on each line, and picking up an "eyeful" of words at each pause. Speed is achieved by increasing the rapidity of the eye movements, decreasing the length of the pause, and taking in a larger number of words during each pause.

While these are the mechanics of eye movements, it is the mind that controls the reading process and better eye movement are but a reflection of increased mental tempo in gathering meanings from printed symbols. So, first of all, set your mind on developing long, rhythmic eye sweeps, with fleeting pauses that gather in everything within the range of vision. **Don't point. Don't say the words with your lips. Don't move your head.** Free your mind from all bodily accompaniments. Let it race ahead unimpeded.

Now that you know what you have to do with your eyes, make up your mind that you must practice. One learns to type rapidly and accurately by practicing; he learns to play the piano excellently by practicing; he learns to skate skillfully by practicing. So it is with reading. As a businessman and a reader of much business literature you must definitely resolve to tackle your reading-improvement program in the same way that you would tackle skill improvement in any other area. **Desire, determination, practice**—these are the basic ingredients in your recipe for reading improvement. Once you've put yourself in the right frame of mind you've made a good start.

Practice . . . Choose the right physical setting for this practice. Don't start your improvement program in the midst of a busy office where phones are ringing, office help is asking questions, and people are coming and going. And don't start it in the living room at home where television is shouting out attention-arresting phrases and the children are playing cops and robbers. You probably can withstand such distractions when you become a highly proficient reader. But to start with, go into a room by yourself—and close the door! Shut the distractions out.

Once you are in a room free from diversions, look for a chair which isn't too luxuriously comfortable. Your period of reading practice is no time to loll. You have a job to do.

First, decide why you want to read the article you are about to tackle. Then read for this purpose. Having a strong purpose in mind helps to pull your eyes rapidly along over the lines, and it gives you something to tie to in gathering meanings.

At this stage in your program, choose an article or a chapter that is fairly easy—an article of business interest, but not technical material or text that is packed with facts. Look at the title and the pictures. These give you clues that you need in the next step.

Decide why you want to read this article. Just to follow the plot of the narrative? To get some ideas that might be useful to you? To find what happened in a current development? Whatever the reason is, phrase it concisely and keep it uppermost in your mind throughout the reading.

Above all, force your speed! Make yourself read faster, faster than you have ever read before. Consciously push your eyes across the lines as fast as you can make them go and still know what you are reading about. Across, back, across, back, across, back, in rapid rhythmic sweeps. Just make those eyes leap over the lines. They are your servants. You can control them. Don't let them loaf along in the old lazy way.

Now see if you can apply all of the things we've been telling you in reading the accompanying article.

Make up your mind to read fast, faster than you've ever read before!

Jot down the time in minutes and seconds.

Ready! Go!

Banks—Yesterday and Now*

Time was—and not so many years ago, either—when the average citizen took a pretty dim view of banks and banking. That this was so, it should be said, was to no small extent the fault of banks and bankers themselves. Banks used to be—and a few still are—grim and forbidding structures, where business was conducted in a sort of genteel gloom, atmospherically and personally. Behind the little barred windows were, more often than not, elderly gentlemen whose cordiality—and that may be an overgenerous word to apply—reflected the size of the customer's account, and nothing less than a few hundred thousand on deposit could have inspired the suggestion of a smile. As for the officers and junior members of the firm—well, the man on the street rarely saw them and perhaps even more rarely thought seriously of speaking to them in a business way.

Now, that appraisal may be a bit too harsh. And yet the average bank for many years was, to the average citizen, an awesome if necessary instrument for the transacting of business—usually big business. But somewhere in the past quarter century—perhaps in the wake of the depression—banks began to grow human, even pleasant, and started to woo the little man, the man who had been in awe of banks and bankers. It is possible that this movement began in medium-sized towns or in small towns where people know each other by their first names, and spread to big towns. At any rate, the results have been spectacular.

The movement to "humanize" banks, of course, received a big push during the war, when more and more women were employed to do work previously performed by men. Also more and more "little people" found

*New York Times, February 17, 1954, p. 30.

The author is director of the Reading Institute at New York University. The three articles in this series are from Dr. Smith's forthcoming book, "Reading Improvement for Adults," which will be published by Prentice-Hall.

themselves in need of personal loans, as taxes became heavier and as the institution of installment buying broke down the previously long-held concept that there was something almost morally wrong about being in debt. All sorts of people began to discover that the intelligent use of credit could be extremely helpful—and this idea was encouraged to grow by forward-looking banks that saw a great future in aiding large numbers of small depositors and borrowers to meet their financial problems.

Today's banks present a picture startling different from that offered by the banks of yesterday. For the most part their officers are accessible and are known to a surprisingly large number of small depositors whom even vice presidents can call by their first names. Some banks even have women—not unattractive, either—as personal loan interviewers. And, of course, at many cashiers' windows—most of which now are barless—pretty young women greet the customer with a smile regardless of the size of his account. Banks today make personal loans that few if any banks perhaps a quarter of a century ago would have considered. For example, not long ago a young man moved to a large city to embark on a new job and appealed to a bank for help in obtaining funds sufficient to move his family to the new location, some distance from his former home. He had no collateral—only a bright future and a creditable past. One bank did turn down his petition — in a friendly way—but another studied his problem and decided to invest in his future. He got the loan. In a not-too-distant past he'd have been regarded as a poor risk by any bank.

In view of the public's increasing acceptance of banks and bankers as friendly counselors, it is indeed surprising to discover that banks feel it necessary to embark on an elaborate public-relations program to make people more conscious of their place in the community and the national scene. It may well be that the role of banks in keeping the nation's financial arteries functioning properly is not as well understood by the public as it might be. But in most communities today's banks and bankers have "sold" themselves and their services at the local level. It may be that the local banker has not yet established himself as firmly as a source of help and counsel as has the family doctor and it may be also that by the nature of his services he never will, but he is making rapid strides in that direction.

Checking Your Speed

Write your beginning time and ending time on the first two lines of the table below. Compute your reading time and reading rate in the same way that you did in Chapter 1. A rate scale is provided for your convenience.

Time Begun	:
Time Finished	:
Reading Time	:
Reading Rate	:
Comprehension Score	:

MINUTES	7	6½	6	5½	5	4½	4	3½	3	2½	2	1½	1
W.P.M.	105	113	122	134	147	163	184	210	245	294	367	490	735
							AVERAGE		GOOD		EXCELLENT		

Checking Your Comprehension

Write "Yes" or "No" at the beginning of each statement.

1. The unfriendly atmosphere in banks of many years ago was the fault of the people who used banks in these times.
2. In the banks of many years ago elderly men usually served at the cashier windows.
3. In spite of the atmosphere within the bank of years ago, officers and junior members of the bank mingled in a friendly way with the citizens when on the street.
4. Banks began to grow more human about 50 years ago.
5. The function of the bank of many years ago was usually considered by the average citizen as that of a place to transact big business.
6. One factor which contributed to humanizing the bank was the popularizing of the institution of installment buying.
7. During the war banks became afraid that large numbers of small depositors and borrowers would add to their financial problems.
8. Drawing a conclusion from the example given, no bank at present would grant a loan without collateral.
9. It may be that the role of banks in helping the nation's financial arteries to function properly is not as well understood by the public as it might be.
10. It is surprising that banks at present feel a need for embarking upon a public-relations program.

Check your answers. Multiply the number right by 10. Record your score.

sɔʌ 01
sɔʌ 6 sɔʌ 9 ɔN 1
ɔN 8 sɔʌ 5 sɔʌ 2
ɔN 7 ɔN 4 ɔN 1

Compare your rate and comprehension score with those you made while working with the material in Chapter 1.
Did you do any better?

Follow-Up Practice

Before you start your practice campaign on speeded reading, do some reading for the sole purpose of checking yourself to see if you have habits which you have formed in the past and which will now interfere with the new speed records which you wish to establish.

● Notice, for instance, whether or not you point to words or follow the lines of print along with your fingers as you read. If so, break yourself of this habit. **One way** to do this is to hold the book or magazine with both hands, one on each side of the opened pages. Your fingers, then, will not be free to point.

● Note whether you move your head from side to side as you read. If so, rest your chin in one hand, and hold it solid. This will prevent your head from moving.

● Watch yourself to see if you vocalize the words while reading silently. If your lips move as you read each word, then you are a pronounced vocalizer, and this will interfere seriously with your speed.

Perhaps you do not actually say the words with your lips, but you still may vocalize to the extent that a slight movement of the muscles in the throat can be detected. If you find yourself vocalizing in either of these ways, place your fingers on the lips or the part of the throat which is moving.

● Analyze your reading habits to see if you reread a great deal. Read a selection and note how many times you go back to reread a word, phrase or sentence.

If you do not reread at all in pursuing nontechnical material, then all is well and good. If you frequently reread, then set about to break yourself of this habit. Just proceed straight ahead. You'll probably be surprised to find that you didn't miss anything, after all.

Next **begin** your speeded reading practice in earnest. This practice should be of two types: (1) General informal practice throughout the day; and (2) specific practice within stated periods of time.

Your general informal practice will consist of forcing yourself to read faster everything that you have to read all day long. Try the same techniques that you used in reading the article above on **everything** that you read.

Do not be discouraged if your comprehension drops pretty low during these first practice periods. This often happens. Don't let a low comprehension score slow you down at this stage. Keep right on pushing yourself to a high speed. Let yourself go, whether or not you are getting the meaning of every thing you cover.

A RIG of Brantly Drilling Co. air drilling a well in the North Eunice area of Lea County, New Mexico. This job was halted for testing when the hole started to make oil.

What Permian basin operators have learned about

WHERE TO DRILL WITH AIR

This two-part article points out many of the possible applications of air drilling and the best techniques for using it. In the first part, Ed McGhee, Journal district editor, tells how and where Permian basin operators are using air drilling. He points out that contractors find air drilling risky on a competitive footage basis because water-shutoff methods are not available. In the second part, M. M. Brantly, one of the leading Permian basin contractors, gives some good tips on how to use air drilling successfully.

by Ed McGhee
District Editor

Part 1

OPERATORS and contractors in the Permian basin of West Texas and New Mexico long ago found they can save money by drilling loss-of-circulation zones with air. They have also proved they can make hole faster and save bits by air drilling. But no one has found a sure way to shut off water zones in the hole, and rigging up for air drilling takes time and cost money. Therefore, the question is one of predicting where there is a long section of hole with no water.

Here are some of the things Permian basin people have found about where to air drill:

1. Drilling with air is a gamble anywhere until a water-shutoff method is perfected.

2. In many wells, air drilling a part of the long hole under the salt string can save money.

3. In the western part of the Delaware basin and in parts of the southern end of the Permian basin itself, drilling shallow hole with air is a virtual necessity because of cavernous formations.

Lost-circulation zones . . . Air for drilling got its start because it can help get through cavernous and other type loss-of-circulation zones. That will likely always be an important application for it.

Many Permian basin wells cut caverns such that the only way to continue drilling with mud is to drill "blind." But, since water is often scarce, blind drilling can be too expensive. In these cases, air drilling has shown up at its best.

Quite often, wells drilling through caverns get no returns even with air. Apparently, the wells cut caverns that take the return air and cuttings just as they would take mud.

One well, still being drilled at the time of this writing, cut two separate caverns, both more than 2 ft. thick and both above 800 ft. There were no air nor cuttings returns after entering these zones. This well is being drilled by Brantly Drilling Co. in Eddy County, west of Carlsbad, N. M.

What formations respond? . . . Any dry formation drills faster with air than with mud. However, the improvement is more spectacular in some formations than in others. In the Permian basin, anhydrites are some of the best prospects with air. Where these formations cause trouble and drill slowly with mud, they cut at 60 to 70 ft. per hour with air—or just as fast as the air can clean out the hole.

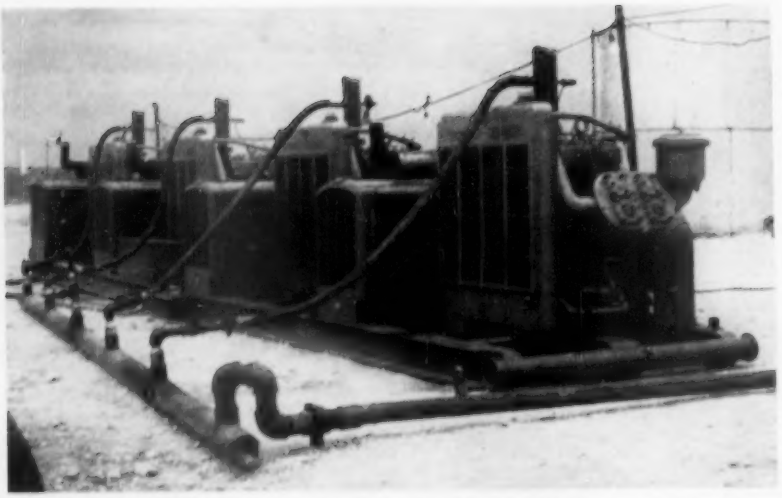
Hard lime formations that drill at 8 to 10 ft. per hour with mud, step up to 25 or 30 ft. per hour with air.

Generally, the more deeply buried a formation, the better it responds to air drilling. Thus far, the greatest depth at which air has been used to drill is 13,000 ft. This figure is for an Eddy County, New Mexico, well.

Coring with air has been successful in several areas. Usually recovery is good, and the core is not contaminated as it would be if taken with mud.

Brantly Drilling Co., which has taken a lead among contractors in air drilling, has used it in wells in all of the areas shown in Table 1. Most of the areas represent several wells. Table 2 includes most of the recent operations of all other operators.

Medium-hard-formation bits . . . Most of the bits used for air (and gas) drill-



RENTAL COMPRESSORS on an air-drilling job. All four engines and four compressors are mounted on a sing'e skid.

ing are medium - hard - formation bits. These are good enough in the hardest zones and will, like almost any bit, drill the softer zones as fast as the air can remove the cuttings. Moreover, many feel that harder-formation bits give nearer-to-gage hole than soft-formation bits.

Other Problems

One of the problems in air drilling is deciding when to pull the bit. The trouble is that the bit loses gage, so that the hole must be reamed. Apparently, a bit will continue to drill even after all the teeth are worn off the cones. As a result, drillers have pulled the bits all the way from "green" to completely worn out.

However, there are very few reports of pulling a bit in which the bearings are bad. Bearings always outwear the cutter surfaces during air drilling.

In some wells, the operators are using insert-type chert bits, with good results.

Limiting factor on the insert bits is wear of the "shirt-tail" area so that bearings can fall out.

What to do about water? . . . The possibility of drilling into water-bearing formations makes air drilling a gamble anywhere. Very often, the zones that stop an air-drilling job are ones that a driller would never recognize when drilling with mud. Electric logs of nearby wells might show a "suspicious" area, but you can never be sure whether it actually carries water—or how much—until the bit gets there.

Most water zones of very low productivity cause no difficulty as long as full air volume is being circulated. The water is simply blown out of the hole as fast as it enters. The trouble comes when the air is shut off for some reason—such as when drill pipe is pulled to change bits. Then, the water has a chance to build up in the hole, hydrate the shales, and bring on hole trouble.

Ordinarily, detecting such a low-volume water zone is hard. Some engineers have suggested using a recording temperature gage on the return-air line. A drop in return-air temperature should show the water zone and give a good idea of its potency.

More water is trouble . . . Some zones don't make enough water to actually stop air drilling, but they do make enough to form a puttylike mixture with the bit cuttings. This putty material collects on the drill stem and walls of the hole. There, it can—and does—stick the drill pipe. In some such cases, Permian basin operators have successfully added water to the input-air stream. The extra water loosens the sticky mixture and drilling can then go on.

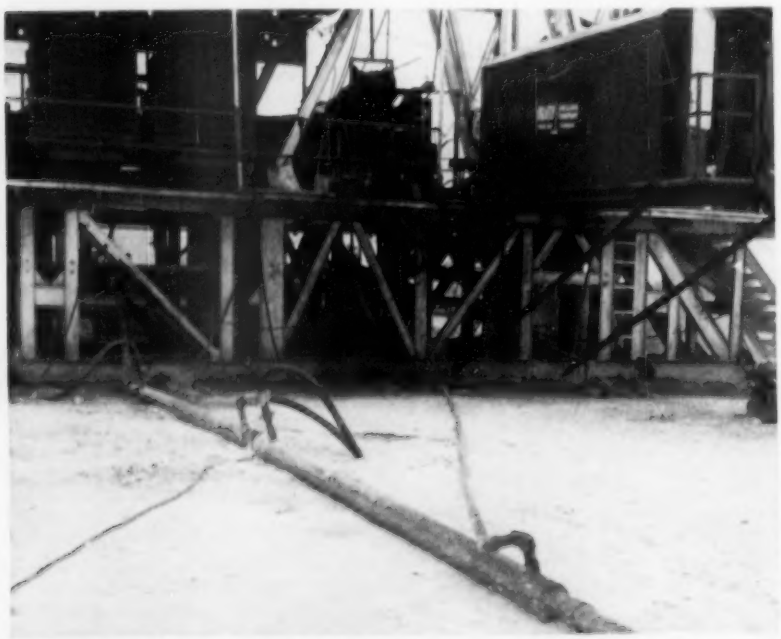
Many in the Permian basin feel this technique is the most promising of any for air drilling.

If water flow into the hole is heavy, there is seldom enough compressor capacity on the rig to keep it jetted from the hole. Then, air drilling must be given up in favor of conventional mud or water drilling.

A lot of remedies have been tried to shut off water-producing zones, but none has proved very successful. Plastics and ordinary-cement squeezes sometimes stop the water but just as often, do not.

What about explosions? . . . Most engineers feel that the danger of underground fire or explosion during routine air drilling is slight as long as good practices are followed. Most important, the blowout preventers and return-air line should never be closed in. As long as they are open, a system of decreasing pressures exists down the drill pipe and up the annulus. With such a system, the conditions necessary for an explosion cannot exist.

There have been at least three wells that had underground explosions while drilling with air. On one of these, a piece of rubber from the inside of



AFTERCOOLER for compressed air. Water circulated through these jacketed sections of pipe keep air temperature and pressure down.

TABLE 1—SUMMARY OF AIR-DRILLING OPERATIONS OF BRANTLY DRILLING CO.

Area, county, and state—	Depth (ft.)	Type drilling
Yarborough, Allen fields:		
Southwest Ector, Texas	3,700 to 4,500	From under salt string
Sand Hills, McKnight fields:		
Northwest Crane, Texas	800 to 2,200	From under surface pipe
North Eunice field:		
East-central Lea, New Mexico	2,700 to 4,400	From under salt string
Sand Hills field:		
East-central Lea, New Mexico	3,000 to 4,500	From under salt string
East Caprock field		
Northwest Lea, New Mexico	2,977 to 3,015	Drilling in Queen sand
Lincoln National Forest:		
Southwest Eddy, New Mexico	Surface to (?)	Cavernous formations

TABLE 2—SUMMARY OF AIR-DRILLING OPERATIONS OF OTHER PERMIAN BASIN OPERATORS

County and state—		Type drilling
Sutton, Texas (Shell Wilson area)	0 to 650	Cavernous formations
Lea, New Mexico (Townsend field)	4,600 to 6,000	Under surface pipe
West-central Eddy, New Mexico	8,100 to 13,800	Under intermediate string
Upton, Texas	5,100 to 5,700	From under salt string
Crockett, Texas	0 to 500	Surface hole
Andrews, Texas	1,800 to 4,500	Air and aerated mud
Scurry, Texas	800 to 2,000	From under surface string
Stonewall, Texas	250 to 1,950	From under surface casing
Lea, New Mexico	1,380 to 2,885	From under surface casing
Ward, Texas	2,350 to 2,450	Air coring
Lea, New Mexico	1,195 to 3,400	From under surface, air coring
Val Verde, Texas	1,300 to 9,000	From under salt string

an air hose came loose and blew down the hole, probably lodging in the bit ports. At the surface, there was little indication of trouble except a puff of black smoke out the return-air line. But when the drill stem was pulled from the hole, a hole several feet long had been burned in the side of one of the drill collars, and the bit was missing.

On another occasion, the drillers shut in the return-air line while drilling was in progress. The idea was to "back up" enough air pressure in the hole to blow out excess cuttings that were building up in the hole. The resulting explosion parted the drill string.

A third instance was during drilling in a gas-pay zone with air. Exactly what caused the fire is not known, but the eventual result was loss of the hole and a good part of the drill string.

Fishing in air . . . Fishing jobs have come up in air-drilled holes, and are little different from those in mud-filled holes. A recent job was a case of bit cones lost on bottom. One run of a magnet on the drill pipe picked up both cones and all but one of the bearings.

Several times, a wet, sticky hole has stuck the drill pipe. When this happens, the operators don't allow drilling to continue long enough for the hole to become completely plugged and for returns to be lost. Then, water injected into the air stream will dilute any cuttings-moisture mixture in the hole and, thereby, loosen the pipe enough for it to be pulled.

Crooked hole has been no special problem in air-drilled wells, nor has there been any undue wear of tubular goods by the air-cuttings stream.

Air on a footage contract . . . A score or more of Permian basin wells have been drilled with air by contractors working on a footage basis. Most often, the operators are glad to cooperate with a contractor who wants to try air, since time is money to the operator too. However, this cooperation seldom extends to protecting the contractor against loss if his hole runs into water after only a shot run. Therefore, a contractor using air on a footage contract is taking his own calculated risk.

Of course, any time the air-drilled hole cuts an oil-producing zone, the contractor and operator are immediately aware of it. That's all very well if the formation is the objective one. However, if it's an unexpected, stray pay, the operator will likely want to test it. Probably, under the term of the drilling contract he has every right to stop drilling to make the test. But stopping a good air-drilling run can only cost the contractor money. So, one of the most beneficial things about air drilling works against the contractor on a footage basis.

How to Use Air Drilling Successfully

by M. M. Brantly

Part 2

ORIGINALLY air was used primarily to combat lost circulation and that will undoubtedly remain one of its primary functions. However, it has been found that in most formations penetration rates are increased and bit life is greatly extended by the use of air.

Since, in the beginning, the requirements as to volume and pressure could only be estimated it has been found necessary to use air-compressor equipment which was readily available. In general this equipment consists of 315 and 600-cu.-ft.-per-minute rotary machines which are built primarily for construction and mine work.

Author is president, Brantly Drilling Co., Inc., Midland, Tex. Paper presented at West Central Texas Oil and Gas Association 1955 annual meeting in Abilene.

One advantage of these machines is the ease with which additional units may be added to the system when needed. **The primary disadvantage** is that, being rotary-type compressors, their pressure is limited to approximately 125 psi. and also their efficiency declines very rapidly in the upper pressure range.

Fitting equipment to need . . . As we learn more about the volume and pressure requirements we will be able to design equipment which will more nearly meet the needs of the drilling industry. There are already two service companies supplying compressor equipment which has been assembled for drilling. This equipment consists of positive-displacement compressors with operating pressures in the range of 200 to 350 psi. Although in normal drilling the required pressure is not this high, the fact that normal operating pressures fall in the middle of the capability range of the machines allows them to operate at a high efficiency.

Control of temperature . . . In almost all cases it is desirable to keep the air temperature as low as possible. This will greatly reduce the wear and tear on all components of the circulating system. An exception to this is when an attempt is being made to dry up moisture in the hole. During this process, where practical, coolers should be

ROTATING HEAD and blowout preventers on a well drilling with air. Notice how the equipment is covered with the dust-like cuttings.

CYCLONE SEPARATOR for return air and cuttings. Cuttings have a consistency about like that of flour or ta'cum powder.

bypassed and the air permitted to enter the hole at a high temperature. As soon as the hole is dry, the air should again be routed through the coolers.

When drilling through an oil-bearing zone it is especially important to keep the air temperature as low as possible. Hot air will drive off the light ends in the oil and the residue mixing with the cuttings will form a gummy substance which is hard to blow out of the hole.

Handling fluids . . . To date there has not been a satisfactory method developed of combating formation fluid which may be encountered while drilling. There have been a few experiments performed in attempting to seal off formation water, but a great deal of work must still be done if this problem is to be satisfactorily overcome.

Recent operations in the Farmington area of New Mexico have indicated that water flows which have been causing trouble in the past may be overcome by a large increase in the volume of air circulated after these formations have been encountered. In one operation which was using approximately 2,000 cu. ft. per minute, it was necessary to suspend drilling operations due to the balling up of the cuttings. A gas line laid to the location permitted gas circulation at the rate of 4,000 cu. ft. per minute. The hole was dried up and drilling continued without trouble from the water-bearing zone.

Shutting off fluids . . . If a satisfactory squeeze method can be developed, it would appear that the best approach would be to drill through the fluid-bearing strata, then perform a squeeze job and continue drilling. One of the primary problems existing now is the lack of a squeeze system which can be used in a dry hole with sufficient cement or plastic to accomplish the desired purpose. It is, of course, possible to shut off the water with a conventional squeeze job, but this would require considerable time since the hole would again have to be dried out completely before drilling could be resumed. It is also possible that some of the formations which have been penetrated would be very susceptible to hydration and, therefore, be a source of serious trouble.

Sampling . . . From the standpoint of the geologists attempting to run samples on a hole being drilled with air, it is initially a considerable handicap. Since, in general, the cuttings have a consistency very similar to flour, it is difficult to obtain positive identification. With some practice, it is believed, the very finely ground cuttings can generally be identified with sufficient

Are you planning to drill with air?

. . . Then consider these factors

1. It has been fairly well agreed upon that an annular velocity of 3,000 ft. per minute is necessary properly to clean the hole under normal conditions. In order to arrive at this velocity the volume must be varied to fit the hole size and drill-pipe size.

2. The penetration rate expected in the formations to be drilled must be kept in mind. The faster the formation will drill, the more volume is required in order to clean the hole rapidly and eliminate the necessity of circulating for extended periods before making connections or trips.

3. Apparently using more air than is required adequately to clean the hole does not increase the efficiency of the operation. As a matter of fact it probably works the other way—by increasing the standpipe pressure, thereby putting an increased load on the compressors and compressor engines. This will also cause an increase in air temperature which if not eliminated by the use of adequate coolers will subject the rotary hose, swivel packing, and rotating head to unnecessarily severe wear.

4. In the case of drilling large holes, it may be impractical to use enough compressors to obtain the desired annular velocity by conventional circulation. In this case the volume requirements can be materially reduced by drilling with reversed circulation.

accuracy for the work being done.

On the other side of the ledger is the fact that all cuttings come to the surface with no contamination or washing. Also, even the lowest-pressure oil or gas-bearing zones can be detected since there is no pressure against them nor is there a wall cake to seal them off. In effect the entire operation has many of the characteristics of a drill-stem test.

Blowout control . . . Since in air drilling there is no mud column to control pressure zones, any oil or gas-bearing stratum which is under pressure will "blow out," but normally this should be no cause for concern. As a matter of fact, a moderate gas blow would assist in cleaning the hole. The oil or gas will pass through the flow line and be exhausted with the air.

It is considered good practice to maintain good mud in the pits so that should the occasion arise, it can be pumped into the hole without any loss of time. Should it become desirable to kill a pressure zone, the mud pump would be started and the air in the hole allowed to exhaust through the flow line or be released through a suitable pressure-release line located below the blowout preventer. By this method the well could be completely controlled in a matter of a very few minutes.

Fire prevention . . . It is important on air-drilling operations properly to train the personnel in the dangers inherent in the system. The primary danger is fire caused by the escape of gas through the rotating head or a leak in the flow line. It is normally considered good practice to designate an area where smoking is permitted and to require all personnel to leave cigarettes, cigarette lighters, matches, etc., in that area.

In cool weather where a fire is necessary, the change house should be located several hundred feet from the rig on the windward side. If it is known that a gas-bearing zone is open in the hole, care should be taken to prevent the accumulation of gas under the substructure and in the cellar, and all personnel should be warned to stay out of possible gas traps.

All engines should be equipped with water-cooled exhaust manifolds and water should be injected into the exhaust lines. If lights are to be used on the rig itself, they should be vaporproof and all wires should be inspected for breaks in the installation. Some contractors, as a matter of habit, disconnect all lights on the rig itself and depend on floodlights placed away from the rig for illumination.

Minimizing dust . . . Although it is not actually a hazard, care should be taken to control the dust around the rig. Unless it is properly lubricated and a good stripper rubber is used, the rotating head may allow considerable dust to escape under the floor. The constant presence of this dust is not only unpleasant, but it can be detrimental to the eyes and lungs of the personnel. In addition to this it may be extremely hard on the rotary table and other moving parts of the rig.

A mixture of bentonite and water poured on the top of the stripper rubber or on the kelly above the stripper rubber will both minimize the wear on the rubber and assist in making a dust-tight seal. The flow line should be unrestricted and of such size as to relieve the rotary head of all possible back pressure.

Coring . . . To date both conventional and diamond cores have been cut using air as a circulating medium. In all cases known to the author the penetration rates have been at least as good as with mud and in most cases have been from 25 to 100 per cent higher.

There has been at least one case in which a diamond bit was heated excessively while drilling with air, but it is believed that by the use of properly designed bits and a sufficient volume of air, this difficulty can be completely eliminated. It has also been found that a diamond bit which is too dull for coring with mud will still cut at a reasonable rate using air.

One great advantage in the use of air is the fact that the core is not subjected to either contamination or washing, thereby simplifying field evaluation of the formation being cored.

Fishing . . . Fishing operations present no more of a problem in an air-drilled hole than in one drilled by conventional methods. Overshot and taper-tap fishing is done in the normal manner and washover jobs present no particular difficulty.

In cases where the hole has not been cleaned sufficiently before making connections, and cuttings have been allowed to settle around the drill collars, it is often possible, by a combination of air pressure and pipe movement, to free the pipe without a great deal of effort. Such troubles as the buildup of excessive wall cake in porous zones are, of course, completely eliminated.

Completions . . . In many areas it is considered unsafe to complete wells with rotary tools due to the low-pressure characteristics of the pay zone, and the damage done to it by the entrance of drilling fluid or the formation of wall cake which tends to block the porosity. Past practice in these areas has been to drill in and complete using cable tools. This not only requires the use of combination rig or a second rig, but is generally a rather slow process.

By using rotary methods and air, the drilling in can be done rapidly without any danger to the pay zone.

For recompletion or cleanout work, air should also be an extremely valuable tool due both to the speed with which the work can be done and the lack of danger of damaging the formation.

It is known that as long ago as 1936, gas was used for drilling in with rotary in lieu of cable tools in certain instances in the Texas Panhandle. Other records show at least one use of gas to clean out after a shot in Monument field of Lea County, New Mexico. Apparently the supposed fire hazard involved was one of the primary reasons that more work was not done with gas until fairly recently.

In areas such as Farmington, N. M., it is now common practice to drill in with gas. After the proper equipment is added to a rig, and the personnel are properly trained to observe safety regulations, there is no outstanding danger involved.

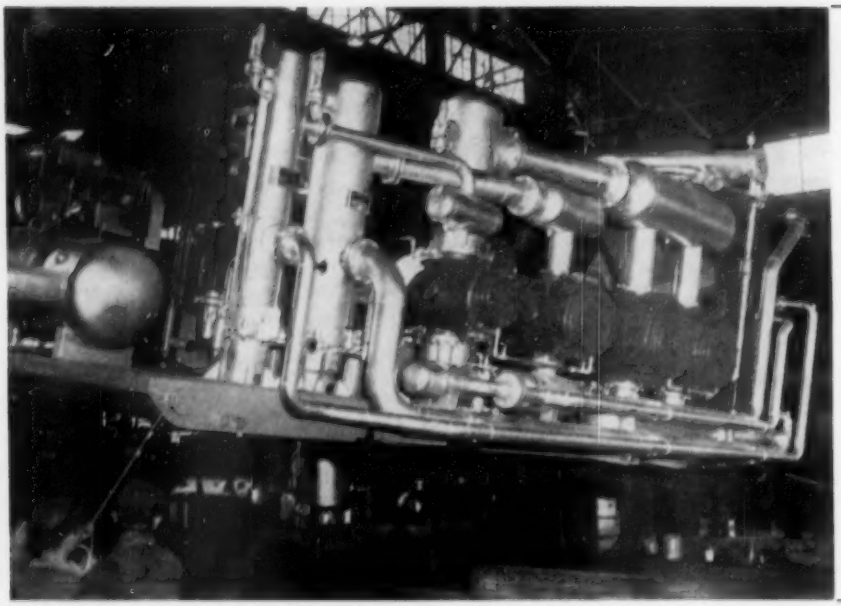
Saves time and bits . . . In recent months there have been many articles concerning the use of air and gas in drilling operations, and there have been many data published. Reviewed here are some of the statistics on a few comparative wells.

Area—	Drilling fluid	Interval, ft.	Bits used	Rotating hours	Penetration rate, ft. per hr.
D-K Abo, Lea County, New Mexico	Mud	3,085-4,497	12	231½	6.1
	Air	3,070-4,463	2	56¼	24.8
Skaggs field, Lea County, New Mexico	Mud	2,565-4,300	11	151	11.5
	Air	2,710-4,347	7	100	16.4
Townsend field, Lea County, New Mexico	Mud	4,630-5,706	10	84½	12.7
	Air	4,680-5,752	3	65½	16.4

As can be seen from the table, the use of air not only increases penetration rate, but will greatly increase bit life, thereby improving the percentage of time on bottom.

Air drilling is still in its infancy and much work has yet to be done before it can take its place in the industry as an accepted drilling method. Cooperation of contractors, oil companies, and service companies is needed to continue its development.

Packaged Compressors in Gasoline Plants



PORTABILITY . . . The packaged compressor unit is an integral unit mounted on skids. Fig. 1.

Questions ? ?

1. Are they practical?
2. What are their possibilities?
3. What do they cost?

Here's how the author answers.

by J. W. Hendryx

FOR the past several years the reservoir engineer, the gasoline-plant-design engineer, and the operators of gasoline plants have been drawn closer together because of the many gas-distillate fields that have been discovered which are of relatively short life expectancy. Short life expectancy in this case means from about 6 to 12 years' operating period. This type of operation demanded that the equipment used in handling these operations be of such type that it could be moved from one job or area to another with as little disturbance to the over-all plant setup as possible. Out of this demand for portability, both in the producing and extracting departments, came this packaged compressor plant.

Portability has become the byword of the industry and all equipment has a definite advantage if designed for easy moves. Even though once it is installed, it may never be moved, it still has a definite advantage if it can be set into the operation as an integral unit with very little over-all engineering and planning on the part of the installer.

The packaged compressor plant has portability in that it is a completely fabricated compressor plant on skids. This means that the cooling system, the lubricating system, the fuel-gas regulating system, the starting air system, as well as the numerous protective shutdown devices are all an integral part of the plant (Fig. 1).

For short-lived fields, many of which are small but profitable operations, several constructors have designed and fabricated small towers and other plant extraction equipment that are portable. This means that with the portability designed into both the compressor plants and the other extracting equipment, many of the once lost small gas-distillate fields can be profitably produced.

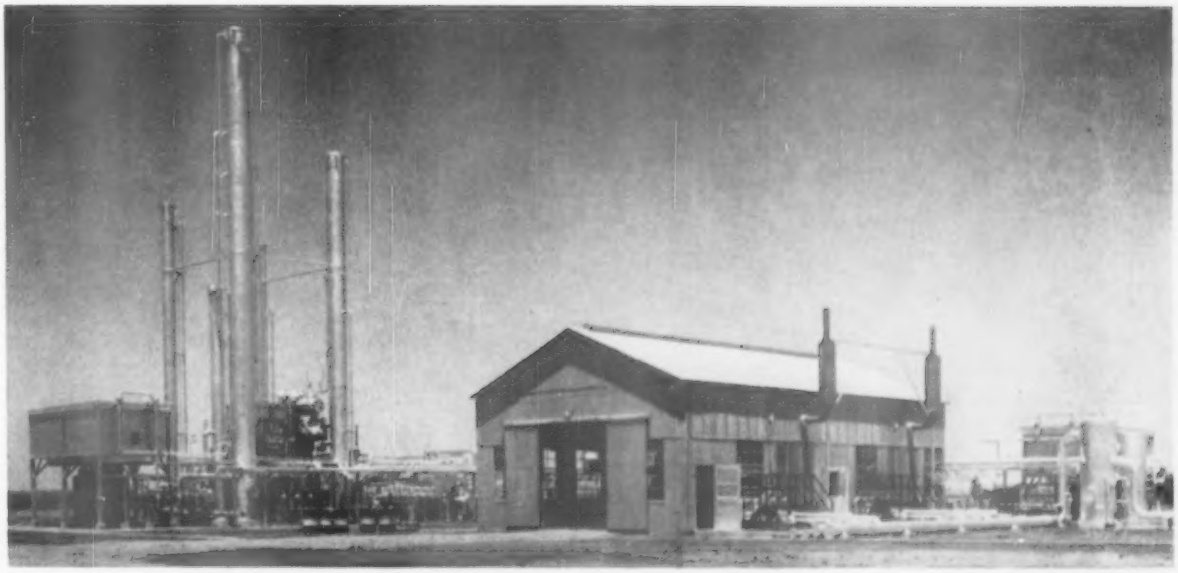
1. Are They Practical?

How is the packaged compressor plant more practical than a stationary installed unit? Our answer is that the packaged unit is: (1) more economical to install, (2) more economical to operate, and (3) if the plant needs to be moved, the salvageability factor can be raised from about 20 per cent to near 50 per cent. That's practical also isn't it? These are some of the features possible with the packaged compressor plant.

Cheaper installation . . . A packaged compressor plant can be installed at less cost because the manufacturer has established a production-line method of output which, once it is established, makes it possible to coordinate activities in such a way that considerable savings can be accomplished. This is passed on to the customer in that he is relieved of the responsibility of designing the piping manifolds, water-cooling system, oil system, and various other details that go into fabricating a complete compressor plant. That is practical.

Cheaper to operate . . . Being "more economical to operate" needs some qualification. If the unit is installed stationary, cooling towers are usually installed, and pumps are needed to move the cooling water between the tower and the units. It takes electricity to run these pumps . . . (some are operated by steam, which is still more expensive to operate) . . . and in our part of the world electricity comes considerably higher than gas in price. Two or three electric pumps of even small size can run up the operating costs considerably.

On the packaged compressor plant the cooling is of course an integral part of the unit, being accomplished by driving a radiator fan which air cools the jacket water, the lubricating oil, and has other sections for gas cooling in the radiator. The power required to do this over-all job usually averages about 3 per cent of the unit's total power output. The water pump, which is also an integral part of the compressor unit, draws no derating of



THREE JOBS . . . Two packaged compressor units do three separate jobs at a small plant in West Texas. Units are set up to handle natural gas, propane, and a small amount of tail gas. Fig. 2.

horsepower from the unit. The unit's power output is rated with the water pump, oil pump, etc., included.

Engine speed control . . . Another practical feature, especially in the four-stroke-cycle engines, is the ease of operation that can be accomplished in control of engine speed and loading. With the automatic speed and pressure regulator setup alone, it is possible to get speed variations from 50 to 100 per cent speed. Then with the automatic valve unloaders and clearance pockets on the compressor cylinders, it is possible to either operate at full load, no load, or at points in between. If a compressor plant is capable of operating itself, then operating personnel are relieved of having to stay right with it, and they can direct their activities towards other needed work. In some cases, fewer operating personnel can be used.

2. What Are Some Possibilities?

One of the best ways to point out what is possible with a particular piece of equipment or process is to look at what has been done with it; and draw some conclusions as to what may be done.

Three jobs in one . . . One illustration for your consideration is a small plant located in western Texas. The plant is equipped with two 10SVG Beaird Ingersoll-Rand packaged compressor plants. These packaged compressors do three separate jobs (Fig. 2).

In order to do these jobs one compressor is equipped with a 20½, 10½, and 6-in.-diameter cylinders with 12-in. strokes, plus a 10½ and a 3-in. cylinder, also with 12-in. strokes. The job of compressing the natural gas from 0 to 545 psia. is done with the first three compressor cylinders. Then the propane service is handled with the next 10½-in. cylinder. Finally, an extra 677 M.c.f.d. of tail gas is handled by the 3-in. compressor cylinder, which was especially mounted on the dummy crosshead of this unit for this particular service. In other words, 398 hp. was used in the natural-gas service, 120 hp. was used in the propane service, and 12 hp. for the extra little job required.

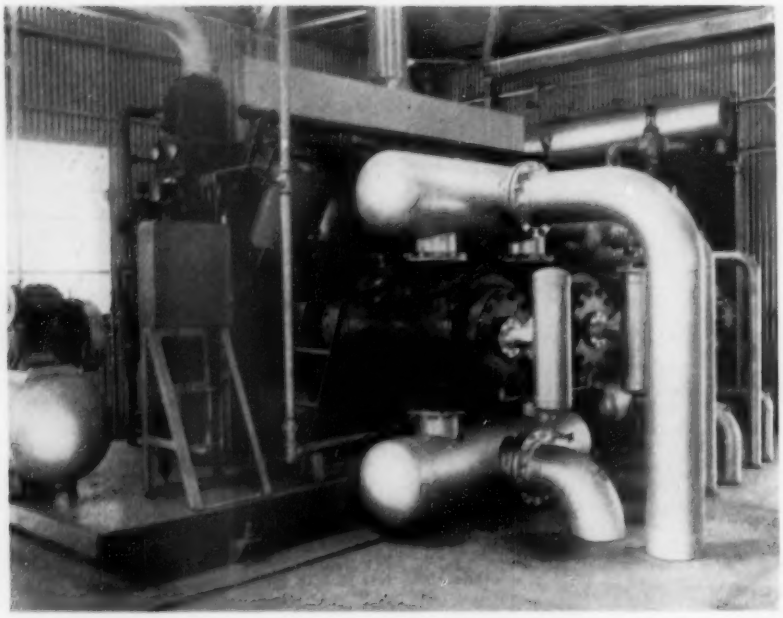
THE AUTHOR

J. W. Hendryx is sales engineer with **J. B. Beaird Co., Inc., Shreveport, La.**, which company he joined in 1951. He is a native of Texas, and studied mechanical engineering at Texas A. & M. He has spent most of his adult life in oilfield and pipeline work. Prior to joining Beaird, he was with Texas Eastern Transmission Corp. for 2½ years. This paper was presented at the N.G.A.A. Shreveport meeting, October 28, 1955.

TABLE 1—PERFORMANCE SHEET—UNIT NO. 2

Service	Gas	Propane	Auxiliary
Number and diameter of cylinders	1—20½	1—10½	1—3
	1—10½		
	1—6		
Speed, r.p.m.	400		
Piston displacement, cu. ft./minute	1,825	472	19.6
Altitude above sea level, ft.	1,700		
Compressing:			
Air or gas			
Type of gas	Natural	Propane	
Dry or wet			
"N" value of gas	1.22	1.15	1.18
Intercooling required?—Yes or No	Yes	No	
Intake pressure:			
Psia.	14.7	41.5	385
Vacuum, in. Hg			
Intake temperature, °F.	120	5	60
Discharge pressure, psia.	545	260	830
Actual delivery at intake conditions, cu. ft./minute	1,200	242	17.6
Actual delivery, M.M.c.f.d., referred to **14.4 psia.** and **intake** temp. (not corrected for supercompressibility)	1.761	1.004	0.677
Pockets open			
Clearance bottles			
Valves lifted or removed			
Brake horsepower (derated for fan drive and altitude)	398	120	12
Fuel, lower heat value, B.t.u. per cu. ft.	1,000		
Fuel consumption, B.t.u. per b.hp.-hour (full load)	8,500		

Note: The actual delivery and brake horsepower can be seriously affected by the manifolding and piping to and from the compressor. The above performance guarantee is, therefore, subject to the customer installing piping connection of a size and type and in an arrangement approved by the company, where such piping is not furnished as part of the unit.



"VEST POCKET" PLANT . . . Here is a packaged unit operating as part of a plant handling 2,500,000 cu. ft. of gas which was formerly flared.

and all of this on one packaged unit. The other compressor unit was equipped with 20½, 10½, and 6-in. compressor cylinders with 12-in. strokes; and served only on the natural gas and propane service. Both units were equipped with automatic speed and pressure regulators which controlled engine speed in accordance with set pressure conditions. (See performance sheet, Table 1.)

Stop flaring . . . Another possibility that the packaged compressor plant has in conjunction with plant operations is using it to convert flare gas into a profit, rather than a loss operation. There are, at present, many packaged compressors in this service and they have played their parts well. These units can be set up in the field and so arranged with speed and pressure regulators and unloading devices that they will operate virtually unattended. These plants are sometimes called "vest pocket" gasoline plants.

One particular station which can be used as an example is a 550-hp. station located near Sweetwater, Tex. The station has one Beaird Ingersoll-Rand 550-hp. unit installed, which is equipped for three-stage operation with processing done between each stage. The plant handles 2,500,000 cu. ft. of gas per day from a suction pressure of 5 psig. to final discharge pressure of 525 psig. which is delivery pressure of residue gas into a sales line. The plant is equipped with automatic controls that permit it to speed up or slow down while maintaining constant processing pressure and volume. Other special control devices protect the unit, and will shut it down if an unusual operating condition should develop. This company reports the operation as very successful with very few shutdowns and these for minor causes (Fig. 3).

Another illustration is a plant located in Runnells County, Texas, used to recover reserves that remained unmarketable until this sort of setup was installed.

In view of the portability, the practicability and the many possibilities, involved in the use of packaged compressors, we feel that this piece of equipment is just in its infancy and that as time goes on you will see many more of them in use, serving the entire petroleum industry.

Short field life . . . One of the large gas companies located in Shreveport had seven wells in Rodessa field where wellhead pressures had dropped below gathering-line pressure. Anticipating a relatively short life for the field, it requested a wide range of operating conditions and **packaging** of the compressor. The flexibility of design and packaging will permit moving the unit to another service almost wholly salvageable. These illustrations, in each case, were given considerable study in regards to installation and operation costs as well as salvageability of the units as integral plants. Packaging proved profitable.

TABLE 2—INSTALLATION COSTS

	Per b.hp.
110 hp.	$310
165 hp.	$265
220 hp.	$230
330 hp.	$210
440 hp.	$195
550 hp.	$185
660 hp.	$175

3. What Do They Cost?

Our discussion wouldn't be complete without some information on installation costs, operating costs and possibilities in this category. Installation costs will, of course, vary with the size of the unit; being highest per unit of horsepower in the smaller sized units and decreasing as the larger packaging units are involved. Table 2 shows some approximate figures.

These are approximate figures of the compressor-plant installation which would include the headers, valves, and the building to house the compressors. In other words the compressor-plant section setup ready to pump gas. These values are based on the use of shed-type buildings rather than the totally enclosed building. Table 3 shows various items of operational costs qualified and itemized so that we can see where major operational costs are located.

Generally speaking, compression costs in the past few months have been approximately 0.75 cent to 1 cent per M.c.f. per stage of compression. In many cases, companies are getting by cheaper than this, and in other cases the cost is more.

TABLE 3—APPROXIMATE OPERATING COST

	Per hp./year
Fuel consumption and cost:	
Based on: 8,500 B.t.u. per b.hp. per hour (full load); 1,000 B.t.u. per cu. ft. gas; 10 cents per M.c.f. cost of gas; 74.46 M.c.f. per b.hp./year	$7.45
Lube-oil consumption and cost:	
Based on: 2,000 hp.-hrs. per gal. (max. expected usage); cost 70 cents per gal. (tax included); 8,760÷2,000×$0.70=$3.07	$3.07
Maintenance cost:	
Labor and parts (20-year period—life of machine). From experience and data compiled by various companies	$3.00
Operating labor:	
Varies with number and size of units installed. Average cost	$5.00
Electric power:	
Average (from operating records of various stations)	$0.23
Miscellaneous supplies:	
Paper, soap, record pads, etc.	$0.20
Automotive:	
Varies—avg. from several stations	$0.26
Total—operation and maintenance	$19.21

Here, in question-and-answer form, is some pro and con on

1. Cat Cracking 2. Cat Reforming 3. Octanes 4. Alkylation 5. Coking 6. Treating

1. Catalytic Cracking

(See also references[1-7])

Feed preheat . . .

Q. When operating at coke-burning capacity and with fresh feed preheat of 350°-400° F., should you gain a significant amount of capacity at a given conversion or additional conversion at a given capacity by preheating the feed to 700°-750° F.?

The general answer to this question is "yes," a significant gain in capacity can be obtained." However, if operating the unit at carbon-burning capacity and feed preheat at about 400° F., then additional heat would be added where it is not needed. But one can take other routes—for instance, hold reactor temperature the same, then reduce catalyst circulation. Then less heat would be taken out of the regenerator and it would then increase in temperature. With less strippable hydrocarbons less air would be needed. Then the unit would drop below carbon-burning capacity and hence an increase in feed is possible.

Slurry withdrawal . . .

Q. On a barrel-for-barrel basis, how much additional fresh gas oil could be charged on a unit operating at coke-burning capacity by withdrawal of slurry?

On the average about 3 bbl. per barrel. Beyond that, it can range from 2 to 8 bbl. and an extreme of 15 bbl. per barrel has been observed. With a 5 per cent carbon laydown from feed, one man reported from his knowledge a laydown indicating a theoretical rate of 10—half on the feed and half on the slurry. It's difficult to tie down any better.

Exchanger fouling . . .

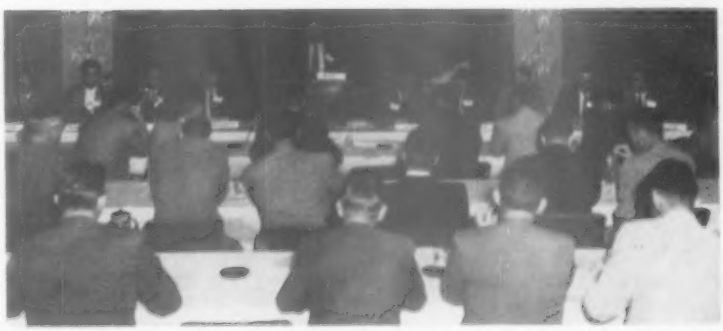
Q. What methods have been used to prevent fouling on the charge-stock side of charge stock-to-circulating oil exchangers? Has inhibitor addition to or oxygen removel from the feed stocks proved effective?

Fouling is generally due to oxygenated compounds found at 350°-450° F. Some companies use inhibitors and others do not. In some instances the gas blanketing of tanks is resorted to to minimize the problem, although (in the opinion of one man) this gives only a slight improvement and is not the solution. Another man said gas blanketing was a good idea, since once oxygen gets to the oil, fouling will increase. Cold gas stripping has helped, and also charging the material directly to the cat cracker without intermediate storage is a good idea if practical in the individual plant. This latter point is substantiated by action in combination units. Wherever the feed does not see daylight, as in these combination units, there is no problem.

Periodic cleaning of the exchangers by chemical or mechanical means is also used. There is no universal solution or method being followed. One company feels that cleaning of exchangers every 3 months was more economical than using inhibitor. But another company, also with a 3-month cleaning cycle, had the opposite experience with inhibitor. Actually, said one panel member, fouling of these particular exchangers was not a problem causing undue difficulty.

Catalyst (high-alumina, cat losses) . . .

Q. With regard to catalyst has anyone converted to 100 per cent high alumina, and if so, how has this new catalyst affected charge rate, yields, performance, and catalyst losses? With regard to catalyst losses has anyone



Panel members:

E. A. Heike, Premier Co., Fort Worth; N. S. Banta, Pure Oil Co., Nederland, Tex.; O. A. Fuchs, Pan-Am Southern Corp., El Dorado, Ark.; Max S. Moody, Lion Oil Co., El Dorado; L. K. Buchanan, Bell Oil & Gas Co., Ardmore, Okla.; Donald E. Ferguson, Refinery Engineering Co., Tulsa; R. R. Maddox, Blaw-Knox Engineering Co., Philadelphia; D. E. Womeldorph, Houdry Process Corp., Philadelphia; J. S. Clark, Esso Research & Engineering Co., Linden, N. J.; Dr. J. F. Walter, Universal Oil Products Co., Des Plaines, Ill. Moderator was Harry K. Wheeler, Pan-Am Southern Corp., El Dorado. Meeting held at El Dorado, Ark., October 20-21, 1955.

been successful in reducing losses without shutting down his unit?

Esso has not used high alumina in any of its plants. In 1946 or 1947 the company did try an experimental run with 20 per cent alumina, which incidentally was not manufactured by the current methods used to make 25 per cent alumina.

The run did not indicate that it had any advantages, and the company has been reluctant therefore to try out the new high-alumina catalyst. Results and data seen so far have not made Esso feel it should be given a try—this of course is strictly a Jersey opinion. There have been some attractive claims made, but realization of these claims has not been seen for Jersey to go ahead and try it. It is known that in several applications by other refiners, after the trial was concluded, the units were recharged with the old type catalyst previously used.

On the other hand, Pure Oil reports using 25 per cent alumina at Smiths Bluff since May 1955. The concentration is now up to 21.8 per cent. As a result, catalyst makeup has been reduced by ½ ton per day. The company has also realized a 15-20 per cent increase in the B-B cut.

There has been a decrease in light cracked distillate. The company is cycling heavy recycle, and it has marked increase in catalyst activity.

Pan-Am Southern also stated it is adding high-alumina catalyst to its 10,000-bbl. per day U.O.P. unit—now about 77 per cent. It has dropped addition rate by 1-1¼ ton per day, with no discard. U.O.P. weight activity has increased from 22 to 26 with the lower addition rate. The CO_2/CO ratio has dropped from 1.12 to 1.02. A decrease has also been experienced in carbon on regenerated catalyst from 0.8 to 0.5.

With regard to catalyst losses and shutting down a unit, it all depends on the reason for the loss. With a running loss and abnormal conditions, if the catalyst ejected gets too high, then it is necessary to shut down a unit. However, as cat losses go up try to determine the cause and avoid bringing unit down. In a few cases the trend has been reduced and the unit stayed on stream.

Jersey reports putting splash plates on the seal pots, and also trickle valves on cyclone diplegs. These valves are shrouded, which protects them and helps to keep them in operation and avoid damage.

If the diplegs do plug during a run, they naturally try to relieve them and reestablish circulation. This can sometimes be done without shutting down the unit. Major breakdowns, such as broken diplegs, naturally can't be repaired without a shutdown.

Using an elutriator . . .

Q. Is anyone employing an elutriator, and if so what are the benefits?

Not many are being used. Lion is using an elutriator and reported from its experience that it has been satisfactory for selective removal of catalyst.

In the Jersey approach, the Model IV units were designed in a different direction. A steam-jet attritor was included as part of the design to break up the heavy material. Most of the Jersey licensees are using these attritors satisfactorily.

Some indicated that when using attritors, the fines going out the stack increased. This is to be expected and stack losses will be a bit heavier with such a system. It is a very effective means of obtaining the desired catalyst particle distribution in the bed. The only caution to be observed is to avoid attrition to the point that catalyst losses exceed the necessary replacement rate.

Spray water in regenerator . . .

Q. What are the detrimental effects when spray water is added above the catalyst bed in the regenerator to reduce regenerator temperature?

"In the Jersey organization maybe we have lost sight of the across-the-board picture," the Esso Research & Engineering panel member stated. This is because the Movel IV units have high velocities well above 2.5 ft. per second. Hence there is considerable entrainment of catalyst. If spray water was used in the dilute phase, too much water would have to be used in the high-entrainment-type unit, having to cool a lot of catalyst plus the gas. To use the necessary amount of water would result in sending the bed temperature into a slump.

Another operator felt that in the lower-velocity units, it would be dangerous to cat activity to use spray water. But the Jersey panel member did not think so. It is generally agreed that it is worse to have contaminants in the water, he stated. This can be avoided by using condensate, which Jersey uses exclusively.

The Jersey practice is to operate the unit to minimize the need for water. A maximum bed temperature of 1,100° F. is held, preferably lower. Oxygen breakthrough is also held at a minimum. Jersey feels that by operating to use a minimum amount of water, not enough will be used to have a detrimental effect on the catalyst. Of course, too much water can affect and lower the activity, but a minimum amount won't.

To utilize sprays to best advantage efficient atomization is required. Sprays should be made removable so they can be serviced on a run. Jersey follows a periodic withdrawal and inspection routine. This is important. As many as 20-25 heads have been seen to go out in an 8-hour run. This was mainly due to erosion with some corrosion.

Regenerator heat removal . . .

Q. Is a steam generating coil better within the regenerator or is it better to go with a steam superheater for removing heat from an F.C.C. generator? The heat removal would be constant.

That constant heat removal is correct, for if one wanted to vary the water rate through the tubes, one might get shock chilling which would crack the tubes. A full wet tube at constant heat load with tubes within the regenerator has performed well on fluid hydroformers.

Q. Has there been any trouble in plating of regenerator tubes in the hydroformer?

Jersey uses a carrier steam medium in a coil circuit. Condensate is injected into the coil to vaporize. In the gas-water ratio in the coils the water is never predominating. It is just enough to wet the surface so they get annular flow with no shock chilling. The condensate is recycled on this system and no plating occurs.

2. Catalytic Reforming

Operating severity . . .

Q. What factors should be considered in detemining the operating severity of catalytic reforming units?

At the May 13, 1953, A.P.I. New York meeting, a paper on Houdriforming economics by Noel, et al, had a good study of this.

Off-gas as fuel . . .

Q. Has anyone experienced fouling of furnace burners when utilizing the off-gas from cat reformers, and if so what method was used to correct this problem?

Houdry reports no fouling has been experienced, at least with Houdriformers. The off-gas is pretty valuable and hence is not used as a medium for heaters, generally.

U.O.P. said it had some reports of some trouble with the off-gas and suggested periodic cleaning of burners and a water wash of the gas. Actually it is probably best to steam-clean periodically.

Corrosion problems alloys . . .

Q. What corrosion problems are being experienced on cat reformers and has anyone experienced a furnace-tube

failure on a cat reformer as a result of corrosion or other factors?

Corrosion has been experienced where water is in the pretreater ahead of the cat reformer. Corrosion may also occur in gas-plant condensate in the condensate strippers in the pretreat section where H_2S and water are present. If there is a high water content in the stock one can expect downstream corrosion. Dry stock lowers corrosion. There were no reports of any tube failures due to corrosion.

Cat reforming charge stocks can be dried by distillation or stripping of water, or else by using solid bed driers containing alumina or silica gel.

A modified Karl Fischer method is used to determine the moisture content of these stocks.

Q. What alloys are being used in the construction of cat reformers charging either hydrofined or low-sulfur stocks, and what precautions should be taken when welding these alloys?

Generally low-chome alloys are used where not so much corrosion is anticipated. They are needed to protect from the hydrogen penetration that takes place at elevated temperatures. Where the service is cold, carbon steel can be used.

Generally, 2¼ Cr is used on reactors, 1 Cr-½ Mo where vessels are unlined. Piping in hot service uses low Cr (¼ Cr).

It is up to the contractor to provide good welding practices, such as preheating and stress relief.

Another panel member made the following remark: In using alloys, there are two characteristics to keep in mind. Chromium is used against H_2S attack, while moly is used where more desirable stress characteristics are needed at higher temperatures.

All cat reformers use alloy now in above 500° F. service. This was formerly the case for 450° service, but the 500° F. point is now observed.

In studies with hydrogen sulfide attack, it was found that for a 10-year life, 4-6 Cr or 2¼ Cr-1 Mo were satisfactory. Again, the 4-6 Cr will result in less corrosion rate with less stress characteristics. The 2¼ Cr-1 Mo will have a little more corrosion but the higher stress will offset this corrosion rate. In effect, both metals could be substituted for each other.

In studies with heater tubes, the best material found was 3 Cr-1 Mo. Where economic factors are important, 1¼ Cr-½ Mo will be satisfactory in some applications.

In some hydrotreating plants, the operators will allow the H_2S to build up to 5 per cent and offset this by specifying 11-13 Cr. On the other hand others prefer to put in an amine unit and go back to conventional alloys.

Pan-Am Southern Corp. gave its experience with an Ultraformer as follows:

"We have an Ultraformer and have had some corrosion. We use 20 per cent Cr ahead of the exchangers in the preheater.

"We have had scale corrosion in preheater section in exchangers and furnace. This resulted in scale accumulating in top of lead reactor—we use three reactors in series—causing deactivation of catalyst. This has been cleaned out and a screen is used to collect the scale.

"We had hot spots on tube in the furnace in the preheater section. The unit was shut down and windows cut in the U-bends. We found 1/16-in. of iron sulfide scale. We were also laying down carbon with the high-capacity throughput. One tube, which had objectionable scale, was replaced.

"The Ultraformer has a different operating setup which causes formation of scale. While other units stay on stream the Ultraformer has a regeneration cycle, and the changing temperatures on the furnace and exchanger causes scale to break off. We do not think the corrosion is serious enough as yet to justify a desulfurization step ahead of the unit. It is felt that it has a 10-year life.

"We now shut down the unit once every 6 months to acid clean the tubes; mechanical cleaning didn't work on the one try it had." (For more on chemical cleaning see forthcoming Journal report).

Here is Premier Oil Refining Co.'s experience with alloys and corrosion:

"We installed a Platformer at the Fort Worth plant in 1951. It was one of the first being built. All alloy was 2¼ Cr. It was built by Premier in the field, rather than contracted. We used 20-25 rod with field welds and made no particular preparations and did not stress-relieve. We had good results with the higher Cr alloys also.

"After 4 years, we have no apparent corrosion in alloy section. We have been getting some FeS scale, but no failure in pipe or heater tubes. The heaters are Petrochem heaters which were retubed.

"The only corrosion was in the stabilizer receiver where H_2S gas attacked it and replacement was needed. We operate our unit to make 96 octane leaded."

Decoking-scale . . .

Q. On the Ultraformer did you think of steam-air decoking through windows in return bends?

It might be tried, but the main trouble is the scale. Very little coke is laid down. Acid cleaning has been very effective.

Coking-fluid hydroformers . . .

Q. Has any coking been experienced on fluid hydroformers with coking in recycle gas stream?

Jersey stated it has not had many reports on trouble due to coke laydown in recycle gas service.

Pan-Am Southern stated that at Destrehan the recycle gas heater coked up. It was felt it might be due to excess lubricant in the reciprocating gas compressor. Cities Service stated that it had a centrifugal compressor and the coking trouble might come from that. The trouble had not caused a shutdown, although there have been some hot tubes.

Hot shell-fixed bed unit . . .

Q. We have a problem with a fixed-unit. The vessel has a monolithic liner 6 in. thick with no alloy liner. The temperature is uniform throughout and it indicates no bypassing. The unit has no exterior insulation. Has anyone else had a similar problem?

One panel member said he had experience with a hot shell. During reaction there was a high temperature due to the pressure drop, and a high shell temperature. This was attributed to bypassing and when the unit was cleaned the temperature became normal. The high temperature was only where there was a high pressure drop.

Another panel member said his company felt it best to put in a metal liner since hydrogen gets into highly permeable insulation.

Another man stated: "We have a 6-in.-thick internal liner on a Houdriformer reactor with 1-in. external insulating refractory; no vapor stops and a carbon steel shell. The skin temperature was too hot, so some of the topmost external insulation was removed and this cured the difficulty."

PLATFORMING

Catalyst . . .

Q. What effect would there be on catalyst life when operating to produce 100-octane reformate from a full-boiling-range East Texas naphtha?

On 100-octane operation, a few plants have been operating on short tests making 100-octane platformate. At one plant 25 bbl. per pound of catalyst has been made and the catalyst is still active. At present 100-octane operation is not unusual.

Q. How is the optimum economic life for Platformer catalyst determined?

Generally, just run with the catalyst charge until quality can't be achieved

within operating limits of the plat—then recharge.

There are some cases where catalyst was run to the level of 125 bbl. per pound. The plants were still getting octane level, but yields dropped off—they changed catalyst then.

Q. Which is the most critical factor in catalyst deactivation with respect to dehydrogenation and isomerization—chloride deficiency or coke deposit?

It depends on life stage of the catalyst. In the early stages there are some limitations on activity due to insufficient chlorides. At the end of its life, it is influenced by coke deposits.

Premier Oil Refining stated it changes the catalyst when yield octane relationship becomes uneconomical. It averages 8 months per run and get to the 120-bbl. per pound level.

Q. Does the presence of water with chlorides tend to activate or deactivate the catalyst? Is the activity a function of water in the charge stock?

It is a function. There is an optimum water content. If it is too low, then you don't have optimum activity and if too high, the same. Varying chlorides in feed stock are hard to pin down to an optimum point. Drying in the prefractionator puts the operation in about the right range. Actually it is the feel of the plant rather than the measure of water in the feed stock which governs the operations.

Removing arsenic . . .

Q. What quantity of arsenic can be removed in a cold clay-treating operation on Platformer charge stock, and what operating variables affect arsenic removal in this operation?

Cold clay treating on straightrun does an efficient job. So long as absorption capacity holds out it doesn't affect performance of treating operation.

There are no operating variables and no particular problem. Just charge naphthas through the clay and it does the job.

Q. Can you regenerate clay used for removing arsenic?

One panel member said he did not know who might be doing this. There is a chance it might work. Of course, the cost of facilities have to be balanced out by savings in cost of clay.

Hydrogen sulfide . . .

Q. What percentage of hydrogen sulfide in Platformer recycle gas may one safely use without encountering excess hydrocracking or carbon laydown on the catalyst?

There are many variables in this such as types of feed stock, severity level, quality, etc. If one has low naphthenes in feed stock it varies or if one aims for higher octanes it varies. It is always important to minimize H_2S.

Another panel member said allowable recycle sulfur is 0.1; in the charge it is 0.025 per cent.

Reactor inlet temperature . . .

Q. What is considered a safe maximum reactor inlet temperature on a Platformer when charging 175° to 225° F. light naphtha?

The answer was that one can't exactly pin this down, but it is approximately 975°-980° F.

Q. How much should the inlet temperature vary to the various reactors in series?

Normally in starting the unit with fresh catalyst, there should be a 5° F. differential below the preceding reactor. However, since the temperature tends to rise as the catalyst ages, the trend is to bring all reactors up to the same level.

Making 100-octane . . .

Q. In referring to the making of 100-octane platformate, what was the per cent naphthene content of charges and what was the space velocity?

The space velocity was about 2.5 and the naphthene content about 35-40 per cent.

3. Octanes

Making 100-octane . . .

Q. What is the most economical way to make 100-octane premium gasoline?

In setting up plant economics, naturally outlook will vary according to the marketing situation and type of crude handled.

Now refiners are looking at catalytic reforming in the 95-100 range. There are various methods to achieve this: Rexforming, with reforming at low severity and extraction of aromatics; reforming at high severity and regenerating the catalyst; Iso-Plus which involves several routes to take, as suggested by Houdry, which combines catalytic and thermal reforming. The Iso-Plus setup has three basic routes: (1) First get higher octanes by regenerating catalyst. (2) Combine catalytic and thermal reforming. (3) Have an extraction unit to remove aromatics and send recycle stream back through reformer, or have a separate reformer strictly for recycle.

But after all these routes are examined, it looks like the limit for catalytic reforming and the question comes up—"What next?"

Basically, a refinery should follow cat reforming and upgrade the naphthenes to aromatics. Following this, other methods must be used and developed to convert normal paraffins to other materials. The one important single component which degrades gasoline is n-pentane. The next step then is to isomerize to isopentane which will improve the octane materially.

Q. How may the refiner determine whether to expand catalytic cracking severity or catalytic reforming to improve motor gasoline levels?

The route to follow will depend on the refiner. Generally, he can look toward higher severity operation of his cat cracker and then more cat reforming. Everyone is also interested in alkylation for the reasons that alkylate blends to increase motor-octane rating readily. Following this would come isomerization of n-pentane, and it is felt the industry is on the verge of this.

Q. Which is the most economical operation on a crat cracker, using cracking severities or TEL on gasoline?

It depends on what level one is talking about. If operation is at a low severity—say 50 per cent—then it is more economical to raise the severity. If at high severity, then add lead as most economical way to operate. It should, of course be remembered that it is the temperature in the reactor rather than conversion which affects the octane level.

N-paraffin isomerization . . .

Q. Has the isomerization of normal paraffins over platinum catalyst reached the point of commercial development? If such a process has not reached commercial development stage, when is it anticipated to be at such a stage of development?

It is felt that licensors are about ready to come out with specific plans for converting $n\text{-}C_5$ to $i\text{-}C_5$. There are certain advantages to using a plant similar to a catalytic reformer since such a plant is easier to maintain and operate as opposed to an isomerization unit of the type using aluminum chloride catalyst.

U.O.P. stated it has one plant operating which has been designed to combine isomerization with reforming. It isn't operating this way but it can. It is believed everybody agrees that the problem in any isomerization step involves separation of the isomers.

(The reader is also referred to paper by Buersetta and Warren[3] on most effective blending to obtain octanes).

4. Alkylation

Acid consumption . . .

Q. What has been the acid consumption on sulfuric acid alkylation plants

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of the Kellogg cascade design when charging a B-B feed; a P-P feed?

Pure Oil (Nederland) stated it doesn't have a true Kellogg cascade system. It has two Stratco reactors in series, then the effluent goes to the cascade reactor. Iso-butane is added upstream of the cascade reactor. On test, it had an acid consumption of 0.584 with B-B feed. Operators have had no experience with P-P.

Cities Service asked whether anyone had experience with acid consumption when charging P-P streams. It was found that acid consumption dropped when charging a combination P-P-amylene stream. Charging a P-P stream the plant operates at about 1.5 lb. per gal. on a sulfuric acid unit. When amylenes are added to this charge stream the acid consumption drops.

Another panel member stated that Phillips at its Sweeny, Tex., refinery was alkylating P-P in an HF unit.

Some figures on acid consumption were given as follows by one panel member: For total alkylate yield of 175 liquid volume per cent of olefin charge, and isobutane consumption of 125 liquid volume per cent of olefin charge, the sulfuric acid consumption was 1.5-2.0 lb. per gal. of total alkylate. The 1.5 lb. per gal. goes with 15 per cent of butylenes in the propylenes. These figures are when making a gasoline with 90-octane number clear motor method (92 clear research).

Another panel member stated that on a design basis (sulfuric acid units), you should run about 2 lb. per gal. with P-P, 0.6 lb. per gal. with B-B, and 1.0 lb. per gal. with amylenes. He mentioned that McMurrey Refining, at Tyler, Tex., is using a mixed feed.

Q. What effect does isobutane-to-olefin ratio have on acid consumption?

Pure Oil stated that this ratio does not have any apparent influence in Pure's operation since Pure operates in a 6-9 ratio range. At low ratios there is an increase in acid consumption, but Pure does not practice this.

Lion Oil Co. stated that a low isobutane-olefin ratio will result in a higher acid consumption and lower-quality alkylate.

Effect of mercaptan . . .

Q. What effect does mercaptan content in feed have?

It will just increase acid consumption mole for mole there are no data as to effect on octanes.

Sulfuric acid units—corrosion . . .

Q. In sulfuric acid alkylation what is the corrosion experience in lines and pumps handling reactor effluent following caustic and water washing of the stream?

Pure Oil said it had corrosion following caustic wash of reactor effluent in transfer pump from water wash drum to deisobutanizer.

Someone asked why they didn't pump the first acid stream and avoid using a pump on water wash effluent to first fractionator, and that way get away from pump corrosion. Answer was that in its design, too much pressure is lost in the system to be able to flow from the drum to the fractionator. Then too, the large water wash drum serves as a surge vessel, hence won't permit constant rates to the deisobutanizer.

Q. In alkylation unit refrigeration system, when alkylating C_4 only, how is propane removed from the refrigeration cycle?

Pure Oil stated it had an autorefrigeration system on the reactor. Originally it used to pull off a propane slipstream.

Q. In sulfuric acid alkylation units, what has been the corrosion experience in depropanizer systems charging condensate from an autorefrigeration system similar to the Kellogg design?

Instead of attempting to remove propane from the refrigeration effluent, Pure Oil lets propane go out with total effluent and takes a slipstream from the deisobutanizer. It vents the refrigeration drum occasionally.

Q. When corrosion is experienced in the depropanizer when using condensate from the refrigeration drum, where does the water come from?

Pure Oil said it was not sure but it collects maybe a cup in a few days. Maybe water would be introduced when shutting down and steaming out. Perhaps if the system were filled from the deisobutanizer it would help, but there is still some moisture. What is needed is a good method for determining water in the system. (For water content in propane and its determination see Shell Oil Co. article[6].)

Cities Service stated it had the same system but did not get water.

Q. Has anyone experienced graphitization of cast-iron pump parts? What steps have been taken to correct corrosion experience?

In the transfer pump (from water wash drum to deisobutanizer) noted above in the Pure Oil operation, a cast-iron impeller has had severe graphitization under some conditions. Sometimes the clearances will reduce within a week's time and the pump will become inoperative. They are still not sure if they should go to high-chromium parts or try to correct conditions basically. They have tested a sample from the water wash drum which is alkaline when drawn but becomes slightly acidic after 24 hours. This weak acid naturally causes trouble.

On the problem of graphitization another panel member suggested a change to modular iron. This is a ductile iron with physical characteristics of steel. This iron has its graphite content in the form of spheres rather than flakes and tends to resist graphitization.

Q. Has anyone had any experience with corrosion in rerun?

Pure Oil reported no corrosion in its rerun. It operates at a low temperature on the reboiler and a minimum pressure—practically a vacuum—on the overhead condenser and has had no fouling of the reboiler. This system is modified from the original design which used hot oil circulation on the reboiler to operate the rerun tower.

Q. Does anyone know of a good bolting material for acid lines on HF units? We have used K-Monel and installed with torque wrenches, but just can't get it to hold—it might be our gasket material.

This is not believed to be a general problem. Try ring-type joint gaskets—use a lead seal compound in making up joints. This should result in no leaks.

Q. In removing all acid from alkylation reactors for complete cleanouts, what methods are used to neutralize the last remnants of acid? Are alkalies circulated prior to unheading?

Pure stated it circulates a heavy water wash with impellers rotating. This water is then drained and the system refilled, caustic is added, and it is held at least 20 minutes to ensure neutralization.

(The reader is also referred to the article by Orr[4] on late-design HF alkylation units and by Goldsby and Putney[5] on one type of H_2SO_4 unit).

5. Coking

Carbon residue . . .

Q. In delayed-coking units, what are the techniques employed to reduce significantly the carbon residue of coker gas oil?

Two methods are:

1. Charge feed directly to the bottom of the fractionator.

2. Install a preflash vessel and withdraw make from it.

Q. Is a Conradson carbon of 0.15 per cent considered to be good on a 30°-gravity coker gas oil from East Texas crude?

It's relative. It is somewhat high, though. It may range from 0.30 to 0.10. It's not too high for use in a cat cracker.

Q. What are the limitations in Conradson carbon content of the coking-furnace charge in delayed coking?

On a unit at N.C.R.A. at McPherson, Kans., this went as high as 30 per cent.

McMurrey at Tyler, Tex., has 8-bbl. charge with 4 per cent Conradson. They use lots of steam and a high velocity through the coking heater. The Conradson carbon in the gas-oil product is dependent on fractionation between the flash zone and the scrubbing effect. Some trays in the unit which were not scrubbed coked up and the Conradson went up to maximum. Trays were realigned and the Conradson carbon came down to 0.15 per cent.

In general at high (35-psi.) pressure, one can expect to make 1.5 times the Conradson carbon in the feed stock. At low pressure one might make about 1.3 times the Conradson carbon in feed stock. This reduced pressure results in less cracking. In fluid coking, one might get 1.0-1.3 times the Conradson carbon in feed stock. The coke volatility is more dependent on the temperature at which the coke drum is held.

Coking at lower pressure . . .

Q. What are the effects on yields of lowering the pressure on coke drums for a conventional coking operation?

Lower pressure means less coke, more gas oil, lower volatility on coke.

McMurrey is running its coke drum at a pressure of 10 psi., using 4,000 lb. per hour of steam and getting good stripping.

Ucan Products at Duncan dropped coke drum pressure from 35 psi. to 25 psi. with a lower receiver pressure. Yield was increased from 55 to 60 per cent gas oil with lower yield on gasoline, coke, and gas.

Chimney temperature on the gas-oil drawoff was raised and recycle was cut back. As a result, softer coke was made which cut decoking time in half from a previous 8 hours.

One refiner, when pressure was reduced on a unit, had trouble with overhead vapor line on a coke drum. The gate valve was replaced with wedge-plug valves and this trouble is eliminated.

Another refiner had similar trouble with overhead vapor lines. It was suggested that if they pinched the valve prior to switching for about 30 minutes the higher velocity would remove some of the coke. This has been done for about 2½ years with no erosion on valves. It has reduced need for three men to operate valve; one can do it now.

Gamma-ray level indicator . . .

Q. What has been the experience when using radioactive cobalt level indicators in coke drums, and what are the benefits gained from their installation?

They do show coke level, they are good for flow rate scheduling. They can be checked periodically to see if the drums are filling too fast.

Pan Am Southern stated it has had them installed for about 2 months and it is too early to say if capacity use of drums has been gained. However, a good indication of the foam level is obtained, and it is hope higher capacities will result. Pan Am has one source and two detectors on each drum and is able to measure rate of coke filling as the level blocks out an element.

Socony-Mobil stated it had two radioactive level measurements on coke drums, with source and receiver at each level (*See The Oil and Gas Journal article**). One is at the 43-ft. outage level and the other at the 25-ft. level. This way both froth and bed level can be seen. It has been possible to raise temperature since levels can be predicted more accurately.

By using the 25-ft. outage as an indicator, the level can be predicted within 6 in. 80 per cent of the time and within 6-12 in. 13 per cent of the time. The 43-ft. outage is not good for predicting.

The question was also asked whether Socony reduced foam by raising transfer line temperature. The answer was that with vapor outlet temperature at 820° F., 10-15 ft. of foam was gotten; with 840° F. temperature 5-10 ft. of foam.

Delayed coking—18-hour cycle? . . .

Q. What are the practical difficulties that might be expected when operating coking cycles on 18-hour intervals rather than 24 hours in delayed-coking operations?

The greatest disadvantage is scheduling crews. At the same time, 18 hours is cutting it pretty short for cooling-opening-breaking out and buttoning up.

6. Treating

Q. Is there a Unifing or similar hydrogen-treating unit operating to desulfurize as well as to hydrogenate coker gas oil or other stocks charged to catalytic cracking units. If so, what are the principal reasons for justifying this operation?

U.O.P. stated it did not have any operating units to process cat cracker feed, but does have one unit to process distillate, and wondered if it is best to process the feed or the cycle oil.

Q. What methods have been successfully employed in the prevention of excess sulfuric acid sludge carryover into the caustic wash in kerosine treating?

In general treating, the system is water-washed or washed with 5° B. caustic. This will wet it before acid treating and is the best single way to prevent soaps from forming with sulfuric acid. One Texas gasoline plant had solubles with the equivalent of 120 lb. caustic to 1,000 bbl. of feed and used just a water wash successfully.

Another comment was that you can also sweeten before acid treating and filter through clay.

Q. Has anyone had experience with a mist arrestor on top of the Girbotol regenerator for the prevention of a mist solution being carried overhead with the acid gases?

Pan-Am Southern said it would probably be a good idea. It uses a blanket in the Ultraformer recycle gas separator and it is very effective in liquid entrainment at high velocities.

Q. What methods are used to prevent or reduce caustic carry-over from caustic scrubbers or settling drums when this caustic is used for removal of sulfide, mercaptans, and acid oils from gasolines?

One refiner had this trouble and licked it by paying close attention to the Baume gravity on prewash—holding it between 8 and 10.

The firm uses 22° B. for mercaptan scrubber to prevent carryover, but 25° B. causes trouble.

Another refiner added 0.3-0.4 octane numbers in gasoline by going to 40° B. for mercaptan removal.

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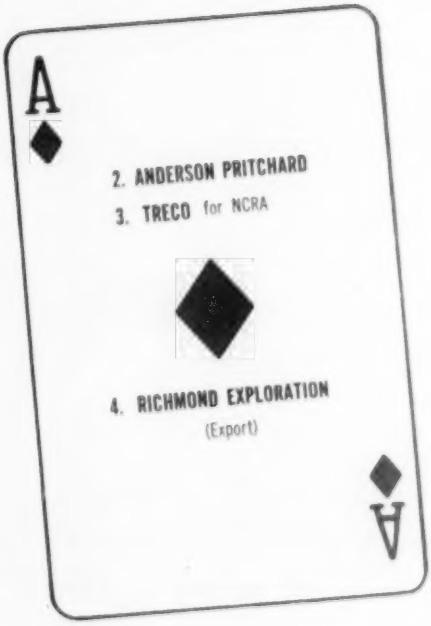

♥♠♣♦ Just like a poker player, the Western Heat Exchanger main assembly bay now and then draws to a "full house". Soon these exchangers will be on their way to Western customers throughout the U. S. and overseas — one more hand finished with new cards to be dealt. There will be other full houses because, again like poker, success in the heat exchanger business depends on judgment and skill — not on luck. You don't gamble when you rely on Western for the winning combinations of design, fabrication and pricing of your heat exchanger requirements.

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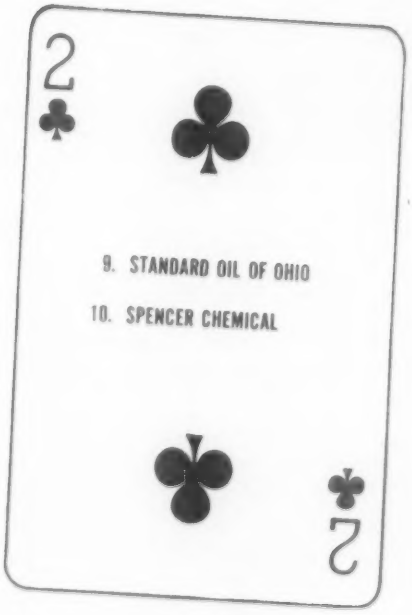
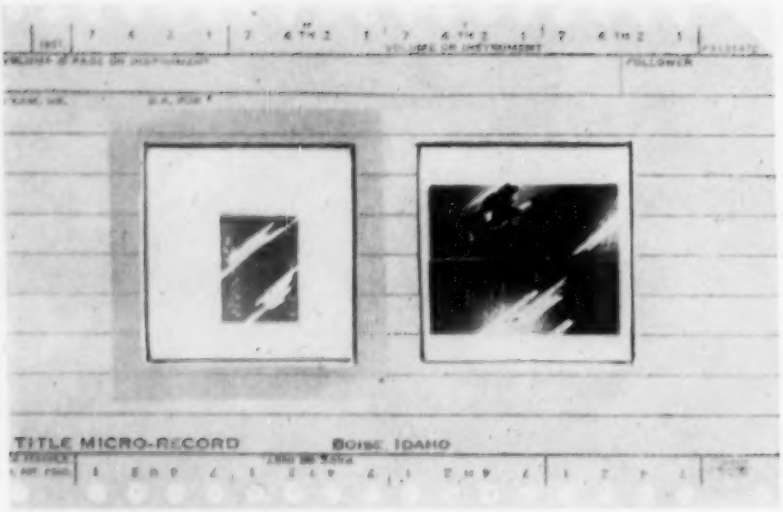
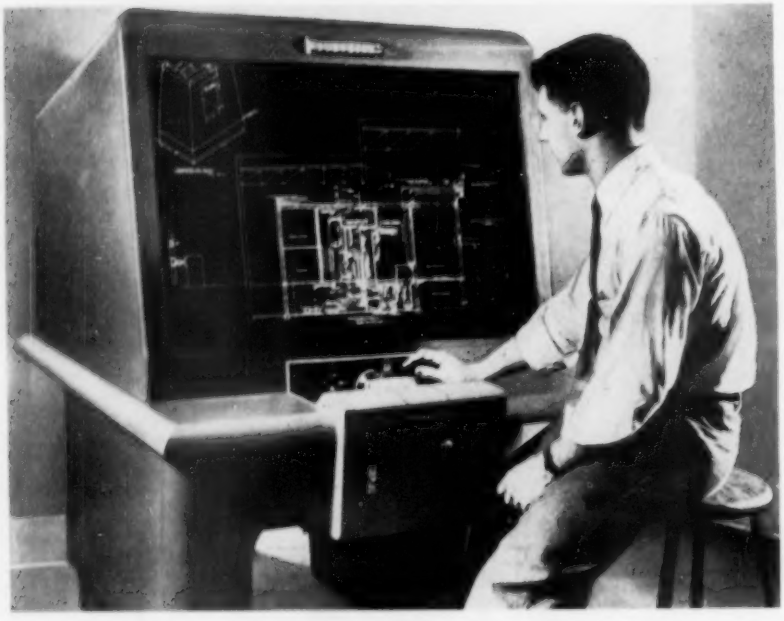




Maybe Microfilm and Punch Cards



Can Solve Your Filing Problem

WHAT does it cost your company to look up, make copies of, and refile a single engineering drawing? It is probably quite high if there are many drawings to be handled and you are using a drawer-type filing system. One branch of the Government used to spend about $15 just for looking up and refile.

At least that was the cost before microfilm and punch cards went into use. Now a combined film-and-card system drastically reduces the time, and hence the cost, needed to find, use, and refile a drawing. The same type system may have advantages for any company in the oil industry.

System Components

Main factors of the new system are (1) punch cards with windows cut in them to take microfilm negatives of drawings, specifications, or similar documents, (2) microfilm projectors with screens for viewing the drawings, (3) a manual or mechanical system for handling the cards, (4) a means of making copies directly from the microfilm.

A microfilm viewer and a punch card with film aperture are shown above. Cards which hold one or several frames of microfilm are in use. Also, viewers in several sizes up to 24 by 36 in. can be bought.

Placing the microfilm frames in the cards presents no problem. There's a special device made which cuts the film and automatically injects it into the card window.

Filing the cards can, of course, be done either manually or by machine. In a small operation the best answer would undoubtedly be manual filing. But with a large volume a company can go all the way with any one of the several mechanical card-handling machines on the market. Even in a manual operation, it's much easier to handle the small cards than the full-size drawing.

Reproductions . . . Some companies would have little use of a system that only allows viewing of a drawing. Copies have to be made and furnished division offices, field forces, machine shops, etc. Equipment is now available which will make these copies directly from the microfilm. Film grain is now so good that faithful replicas can be made of almost any size drawing.

So, with the complete system (all four components listed above), an original drawing would never have to be handled after it was microfilmed unless design changes were made. All working files could be film records. All copies for field or district forces would come from the microfilm negatives. The original could then be filed and forgotten—permanently.

Several Systems Possible

With the basic components, several filing systems are possible. Choice would depend on the number of filings, whether copies are required often, and the speed required for filing and recovering from the file. For example:

. . . For a small operator—a card file system plus a microfilm projector and a copying method might be enough. But

. . . For a big company—with a complex filing problem, a machine to handle the file cards probably would be added. Then, additional viewers, copying machines, and sets of file cards might be sent into field or division offices. With not too good an investment, a division office might have a complete file of all drawings and records that are customarily kept in home offices.

Photographs above courtesy Dexter Folder Co., Pearl River, N. Y., manufacturers of the equipment.

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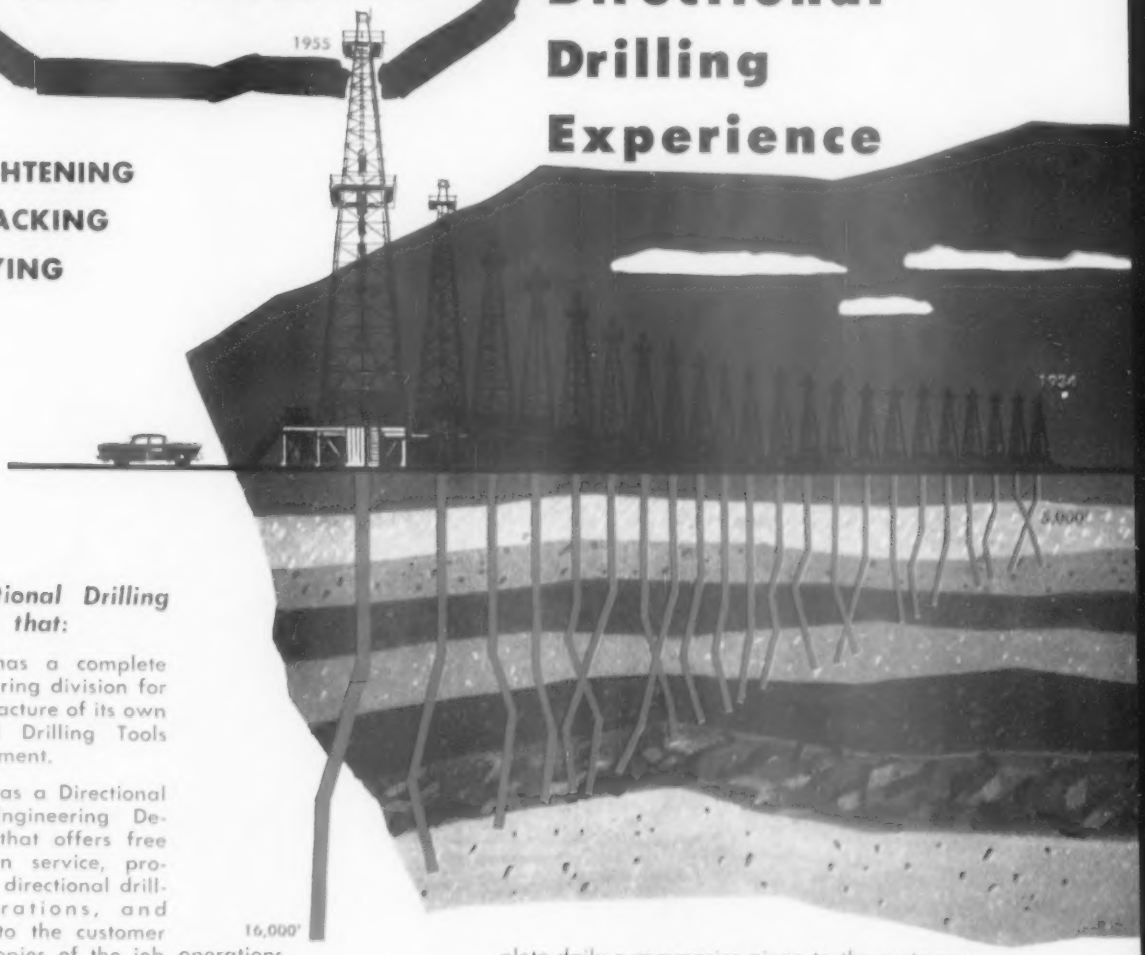

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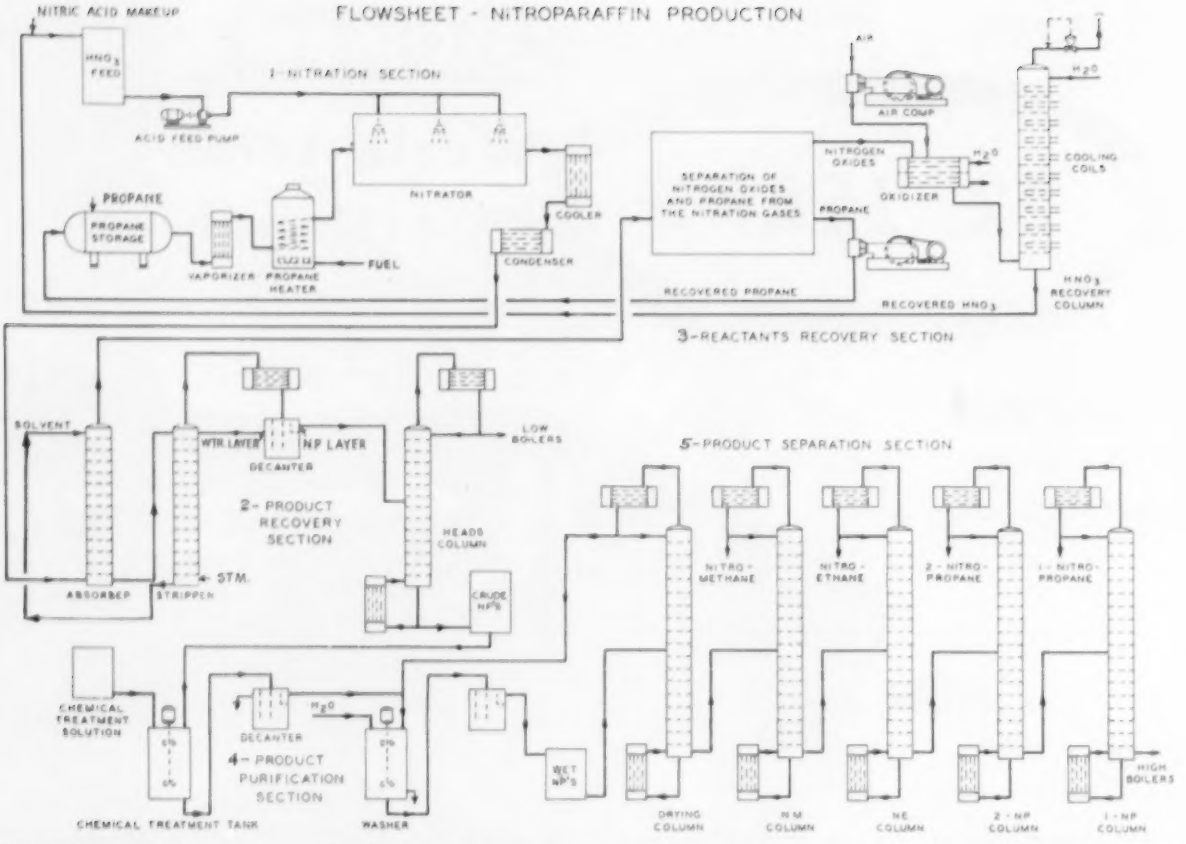


MAKING NITROPARAFFINS . . . Simplified flow diagram shows vapor-phase nitration of propane employed by Commercial Solvents Corp. at its new Sterlington, La. facilities to make nitroparaffins. Fig. 1.

PETROCHEM REPORT

PROPANE TO NITROPARAFFINS

Vapor-phase nitration used by C.S.C.

by John C. Reidel
Petrochemical Editor

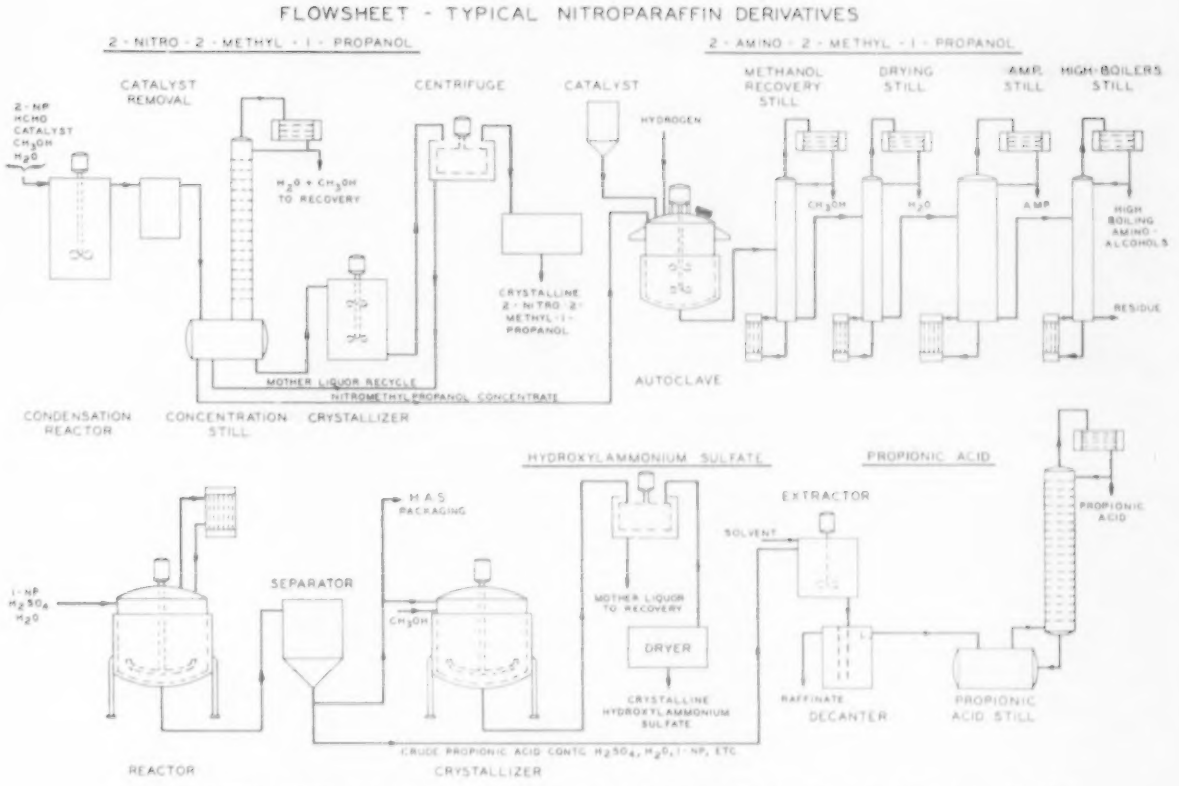
At its Sterlington, La., plant, Commercial Solvents Corp. is now making a new family of petrochemicals—the nitroparaffins. Nitromethane, nitroethane, 1-nitropropane, and 2-nitropropane are being produced commercially. New facilities at Sterlington went on stream in August of this year. Design capacity is over 10,000,000 lb. per year of nitroparaffins. Nitrobutane and its derivative 2-nitro, 1-butanol, although not being made initially, can also be produced in Commercial Solvents facilities. Commercial production of these new petrochemicals was attained after more than 20 years of research and development.

Installation of the nitroparaffin facilities at Sterlington and expansion of derivatives - manufacturing capacity at Peoria, Ill., involve expenditure of some $5,000,000. A new nitroparaffin-derivatives plant is under construction by the company at Terre Haute, Ind.

• The vapor-phase nitration at Sterlington consists of reacting an excess of propane with nitric acid in an adiabatic reactor employing nitric acid sprays. The heat of reaction is employed to preheat and vaporize the nitric acid. In earlier experimental work fluidized-bed nitrators were also employed. These, however, did not prove as satisfactory for scale-up to commercial operation as the spray-type adiabatic reactor.

• Following nitration, unreacted propane and nitrogen oxides are separated from the reaction products. A small amount of aldehydes, and other compounds formed by side reactions, is scrubbed out. Nitroparaffins are further

PETROCHEMICALS



MAKING DERIVATIVES . . . Manufacture of several typical nitroparaffin derivatives is shown here. **Fig. 2.**

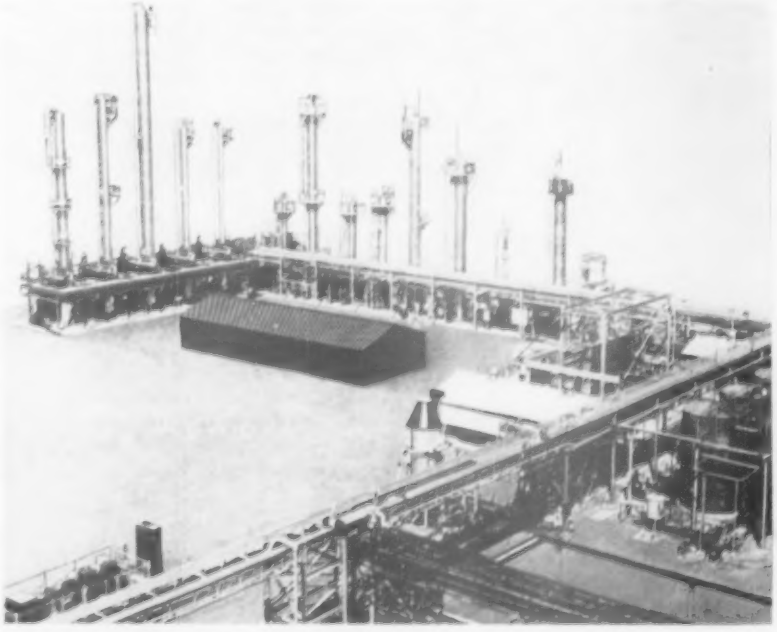
purified by chemical treatment and separated by fractionation.

● Primary use of the nitroparaffins is as solvents. But the highly reactive nitroparaffins also offer many possibilities as chemical intermediates.

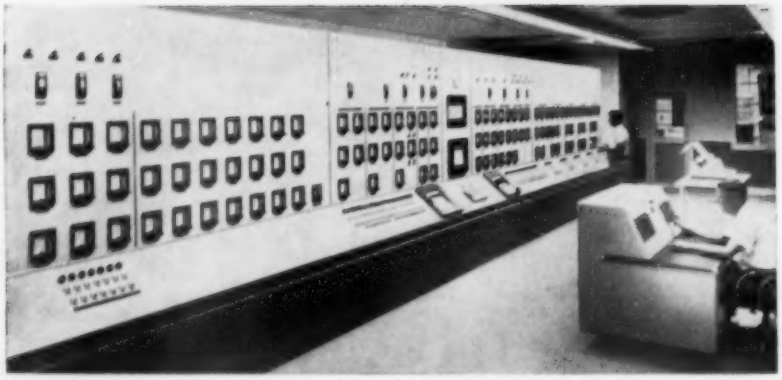
● Existing facilities at Sterlington make ammonia, nitric acid, ammonium nitrate, and methanol. Here is how the new operation fits in: (1) Nitric acid, used at Sterlington for ammonium nitrate manufacture, also happens to be most suitable for nitration of propane. (2) Methanol and its derivative, formaldehyde, are required to make some of the nitroparaffin derivatives. (3) Other derivatives are prepared by hydrogenation; hydrogen is available from the gas-synthesis sections of the ammonia or methanol plants.

In developing the vapor-phase nitration, many problems were solved. Some examples: New-design nitric acid spray nozzles had to be developed. New alloys were needed for operation with corrosive chemicals at high temperature and pressure. Control techniques had to be adapted to the nitration process, especially for close temperature control. Optimum nitration is obtained within a narrow temperature range. On one side of this range, the yield is smaller—nitration is incomplete. On the other side, the reactions go over from nitration to predominantly oxidation and decomposition.

Many problems were also encountered in the research on derivatives. To give an idea of the work involved, over 2,000 derivatives have been prepared in Commercial Solvents laboratories. The company operates under



NITROPARAFFIN PLANT . . . The arrangement at Sterlington, La., permits maximum flexibility for building of additional nitroparaffin units as desired. Low structure in center foreground is control building.



PROCESS CONTROL . . . Over 100 recorders and controllers are on instrument board. Data reduction system is used to scan continuously some seventy key temperatures (note console at right foreground).

nearly 140 patents on nitroparaffins and their derivatives. Market development, too, has had its share of problems—as might be expected in the introduction of a whole new chemical group and its derivatives.

In designing the Sterlington nitroparaffins plant, Commercial Solvents Corp.'s engineering department incorporated a central control panel with over 100 miniature recorders and controllers. A data-logging system is also provided in the form of a console desk. Seventy key temperatures are continuously scanned and typed out on the plant log sheet at preset intervals. Deviation of a key temperature from the control point is brought to the operator's attention by an alarm.

Level indications for all tanks are also on the central panel, as are alarm lights and start-stop switches for all motors in the plant, duplicating the switches mounted locally at each motor installation.

An infrared analyzer is employed on the nitric oxide stream in the reactants recovery section of the nitroparaffins plant. A mass spectrometer is used for nitroparaffin analysis. In the derivatives preparation a hydrogen analyzer is used.

How Nitroparaffins Were Developed

Activities of Commercial Solvents Corp. in petrochemicals are summarized in Table I.

Basic patent . . . Glimpses of the vapor-phase nitration development have appeared over a period of years in the literature through the papers of Hass and coworkers.[1-9] Basic patent for vapor-phase nitration is that of Hass, Hodge, and Vanderbilt[1] issued to Purdue Research Foundation.

Pilot plant . . . This was built at Terre Haute to follow up the bench-scale work. Nitric acid was vaporized in one stainless steel coil and the nitration was conducted in another coil. The coils were heated by molten salt baths. This work showed need for better materials of construction. Data was obtained for design of a semicommercial plant. Nitroparaffins obtained from this pilot plant were studied for reactions and uses. The C.S.C. market development group began studying market possibilities.

Semicommercial . . . In 1940, the development-scale plant was built at Peoria with a capacity of 1,000,000 lb. per year. The nitric acid vaporizer was made up of a large silicon-iron inner pot suspended in a stainless steel outer pot heated by hot flue gases. Acid was introduced into the silicon-iron inner pot and contacted this pot only.

The stainless steel outer pot provided the mechanical strength required for the operating pressure and temperature. Better methods for separation of reaction products and purification and separation of the nitroparaffins were incorporated into the Peoria unit.

Developing the nitrator . . . In the semicommercial or development stage, the silicon-iron pot for pressure vaporization of nitric acid proved adequate. But its contemplated use in a commercial-scale plant posed some problems: (1) The vaporizer pot at Peoria was the largest which it was practical to cast; use of a number of vaporizer pots of this size in a larger over-all plant was an uneconomical approach. (2) Removal of heat of nitration in a large-scale plant loomed as a major problem.

The development now turned in two directions. One was toward an adiabatic reactor employing a number of nitric acid sprays. The other was toward a fluidized bed system. Cost estimates showed that the spray type would be cheaper to build. It also had some operating advantages.

While the nitrator was under development, work continued on other phases of the project. Chemical treatment was developed to eliminate trace impurities, making water-white, noncorrosive nitroparaffins. More derivatives were prepared and the market development work continued.

Commercial plant . . . This was authorized in 1954 and went on stream in August 1955. First shipment of nitromethane went to Peoria for deriyatives manufacture in September. Plant is now in full operation. This is the first instance of commercial production of these nitroparaffins in the United States.

Imperial Chemical Industries began manufacture of these chemicals in England in 1946. E. I. du Pont de Nemours & Co. had produced a nitrocyclohexane continuously in pilot plant by liquid-phase nitration under pressure. Pilot-plant nitration of methane and propane was conducted by I. G. Farbenindustrie in Germany during World War II.

How C.S.C. Makes Nitroparaffins

The simplified flow sheet, Fig. 1, indicates basically how nitroparaffins are made at the Sterlington plant. Major steps shown are: (1) nitration, (2) products recovery, (3) reactants recovery, (4) product purification, and (5) product separation.

1—Nitration

The broad temperature range for vapor-phase nitration is 400°-1,300° F. The actual temperature selected depends on the raw material, nitrating agent, and product desired. An optimum temperature exists for nitration of a given hydrocarbon. Other important variables are the relative proportion of reactants, reaction time, and pressure. At a fixed pressure and fixed mole ratio of reactants, the temperature and reaction time can be selected to obtain constant total yield of nitroparaffins. Shorter reaction time and higher temperatures result in decreased conversion. Precise temperature control is important under these conditions.

For rapid (up to 1 second) reaction the temperature range is originally 700°-850° F., in which range the nitro group can replace any hydrogen atom or alkyl group to produce mononitro alkanes. For production of nitrometh-

ane, nitroethane, 1-nitropropane, and 2-nitropropane by reaction of propane and nitric acid, it has been stated[19] that a temperature of 770° F. is used at pressures of 115-175 psi.

The effect of increasing pressure is more important in nitration of hydrocarbons of higher molecular weight than it is for methane. As pressure is increased, optimum temperature and contact time decrease; it becomes more difficult to control the temperature and maintain most efficient time-temperature relationship. Nitration of propane commercially requires control of the reactor to within 1° F.

Propane is more readily nitrated than methane or ethane. Better yields and distribution of nitroparaffins are obtained. Control of operating variables is easier. Use of nitrogen dioxide as nitrating agent gives the same nitro alkanes as nitric acid, but yields are much lower. Nitric acid is also the cheapest nitrating agent.

Literature . . . Only a brief rundown of the literature can be given here. Actually there are many more references extant than those cited here. Hass, Hodge and Vanderbilt[2] gave bench-scale results in vapor-phase nitration of paraffins at 420° C. (788° F.). They noted that the effluent from the reactor consisted of two layers.

The lower layer was essentially very dilute nitric acid. The upper layer contained the nitroparaffins. Rectification curves for this upper layer were presented showing a low-boiling fraction consisting of water and nitro compounds followed by plateaus indicat-

TABLE 1—COMMERCIAL SOLVENTS CORP. IN PETROCHEMICALS

	Raw material	Principal products
Sterlington, La.	Natural gas	Ammonia (400 T/D), ammonium nitrate, nitrogen solutions.
	H_2 and CO (from ammonia operation)	Methanol.
	Propane, Nitric Acid	Nitromethane, nitroethane, 1-nitropropane and 2-nitropropane. (New facilities can make other nitroparaffins such as nitrobutanes.)
Sterlington (Pace's Lake), La.	Ammonia, Nitric Acid	Ammonium nitrate.
Sterlington, La. (Thermatomic Carbon Co.)	Aromatic oil feed	Carbon black (furnace process).
Peoria, Ill.	Nitroparaffins	Nitroparaffin derivatives—facilities being enlarged. (Peoria also has pilot and development facilities for making nitroparaffins from natural gas fractions.)
Terre Haute, Ind.	Nitroparaffins	Nitroparaffin derivatives—plant under construction.
Medicine Hat, Alta. (Northwest Nitro-Chemicals, Ltd.)—in association with British Dominion Oil, Ltd., Ford, Bacon & Davis, and others	Natural gas	Ammonia, nitrogen and phosphate fertilizers (plant planned for completion in early 1957).

TABLE 2—NITROPARAFFINS AND THEIR DERIVATIVES

Nitroparaffins—	Boiling point, °C. at 760 mm	Specific gravity,* 25/25° C.	Refract. index, n_D at 20° C.	Purity,† and wt., min.	Dist. range,* °C. at 760 mm., 90 per cent min.	Uses
Nitromethane CH_3NO_2	101.2	1.124-1.129	1.3818	95	100-103	Solvent for nitrocellulose, cellulose acetate, cellulose acetate butyrate, acrylonitrile polymers and polystyrene; synthesis of insecticides, explosives, and other chemicals; ingredient of special racing and model engine fuels; propellant.
Nitroethane $CH_3CH_2NO_2$	114.0	1.044-1.048	1.3916	90	112-116	Solvent for cellulose esters and vinyl resins; for synthesis of pharmaceuticals, insecticides, surface-active agents; ingredient of synthetic finish removers.
1-Nitropropane $CH_3CH_2CH_2NO_2$	131.6	0.997-0.999	1.4015	94	129-133	Solvent for cellulose esters, vinyl resins and dyes; for synthesis.
2-Nitropropane $CH_3CH(NO_2)CH_3$	120.3	0.986-0.990	1.3941	94	119-122	Solvent for cellulose esters and vinyl resins; for synthesis; heat sensitizer for rubber latex; ingredient of synthetic finish removers.

*C.S.C. (tentative) specifications. †By mass spectrometer; total nitroparaffin content is 99 per cent by weight, min.

Derivatives—	Uses
2-amino-2-methyl-1-propanol $CH_3C(CH_3)NH_2CH_2OH$	Emulsifying agent (in form of its soaps) in floor wax, cleaners, polishes, paints; stabilizer in urea and melamine enamels; raw material for synthesis; ingredient in textile, leather and other specialties.
Tris(hydroxymethyl) aminomethane $(CH_2OH)_3CNH_2$	Emulsifying agent (in form of its soaps); for synthesis of drying oils, synthetic resins, textile specialties; analytical reagent.
2-amino-2-methyl-1,3-propanediol $CH_2OHC(CH_3)NH_2CH_2OH$	Emulsifying agent; raw material for synthesis; ingredient of textile specialties.
Hydroxylammonium acid sulfate $NH_2OH.H_2SO_4$	Reducing agent, especially for metal ions; for synthesis of pharmaceuticals, dyes, rubber, photographic chemicals, synthetic fibers.
Hydroxylammonium sulfate $(NH_2OH)_2.H_2SO_4$	Reducing agent, especially for metal ions; reagent in dyeing acrylic fibers; synthesis pharmaceuticals, rust and polymerization inhibitors, dyes, rubber and photographic chemicals; nondiscoloring short stopper for polymerizations.
Oil-soluble surface-active agents	Emulsion stabilizer and acid acceptor; pigment grinding aid, dispersing agent for solids in organic liquids; antifoam agent; used also in metal cleaners, polishes and lubricants.

ing in order the four nitroparaffins dealt with here.

Hass and Shechter[7] gave empirical rules characterizing the reactions between nitrating agents and saturated hydrocarbons. Hass and Alexander[8] dealt with the effect of pressure on the reactor.

Bachman and Pollack[9] stated that normal distribution in vapor-phase nitration of propane was as follows: 25 per cent of 1-NP, 40 per cent of 2-NP, 10 per cent of NE, and 25 per cent of NM. Bachman and Pollack were studying means to control the separate yields and how to minimize the degree of degradation if it were desired to make higher nitroparaffins. Specifically, effect of halogens as catalysts in vapor-phase nitration of propane and of natural gas were investigated.

Other investigations have also dealt with effect of adding air or oxygen with the aim of obtaining greater yield of oxidation products as well as nitroparaffins.

Adiabatic nitrator . . . Basic design problems in carrying out vapor-phase nitration under pressure are: (1) high temperatures—let's say in the range 750°-850° F., (2) short reaction times—in the range 0.1-5.0 seconds, and (3) corrosiveness of nitric acid. One approach was to use a fluidized bed of inert solids. This was employed to transfer heat of reaction from a nitration vessel to a vaporizer vessel.

A second approach was to use the heat of reaction to vaporize the nitric acid by introducing concentrated HNO_3 liquid in small increments through spray nozzles. The trick here, of course, is to design and locate the nozzles in such a manner that proper heat balance is achieved and the nitrator temperature can be closely controlled.

The many competing reactions which take place during vapor-phase nitration tend to obscure somewhat the kinetics of the primary nitration reactions. However, the reaction kinetics have been studied and were of help in design of the adiabatic nitrator. Egly[11] has commented on the kinetics. Nitration takes place as a first-order reaction. Egly presented an equation for optimum residence time in vapor-phase nitrators. Much longer residence time is required in fluid-bed nitrators, or in coil nitrators with very large ratios of surface area to reactants than in adiabatic nitrators. Surface appears to slow the overall nitration reactions.

2—Products Recovery

The oxidation and decomposition reactions which accompany and compete with the nitration reactions in the vapor-phase process may result also in production of aldehydes and ketones, of alcohols, carboxylic acids, olefins, nitroolefins, and polymers as well as CO and CO_2. Also nitrites and nitroso compounds may be found in the products.

Nitration is so conducted that formation of nitrogen is minimized. Effluent gases do not contain much nitric acid or nitrogen dioxide. The principal product resulting from reduction of HNO_3 is nitric oxide. Water is another reduction product.

Absorption . . . The nitrator effluent is cooled, condensing the nitroparaffins, and is brought down to atmospheric pressure. The remaining vapor then consists of nitric oxide, some inerts, unreacted propane, and a small quantity of aldehydes, ketones, etc. The vapor-liquid mixture goes to the absorber where the products of oxidation reactions are scrubbed out with a solvent such as a solution of hydroxylamine hydrochloride.

The off-gas from the absorber consisting of nitric oxides and the unreacted propane go to the reactants recovery section. Prime reason for scrubbing is, therefore, to insure that aldehydes, ketones, etc., are not recycled with the propane. The liquid nitroparaffins go with the rich solvent to the stripper.

Stripping . . . In the stripper the solvent mixture is regenerated and lean solvent is recycled to the absorber. The stripped nitroparaffins together with the small amounts of oxidation products are condensed and form one of the layers in the decanter or separator.

The other layer, consisting of water with perhaps a very small amount of nitric acid, is used to reflux the stripper. The nitroparaffin layer goes to the heads column where the cut is made for initial boiling point of nitroparaffins fraction. Low-boiling aldehydes, ketones, etc., are removed here. The crude nitroparaffins fraction now goes to the product purification section.

3—Reactants Recovery

In the nitration only a portion of the HNO_3 is used to form nitroparaffins. Part of the HNO_3 also acts as an oxidizing agent to form nitric oxides. Fig. 1 indicates continuous nitration made possible by separation from the products and from unreacted propane of nitric oxide which is reoxidized to nitric acid.

This recycle enables the nitroparaffin yield (calculated on the basis of nitric acid) to approach the theoretical. Some 90-plus moles of nitroparaffin can be obtained per 100 moles of HNO_3 used up.

4—Product Purification

During development work it was found that trace impurities in the nitroparaffins made them corrosive to ordinary carbon steel and unstable. They gradually became yellow in color during storage. A chemical treatment was developed. This involves contact between two immiscible liquids and a slow chemical reaction. It is therefore conducted with agitation in a chemical treating tank as shown. Water washing completes the purification and the nitroparaffins are ready for separation.

5—Product Separation

Water is removed from the wet nitroparaffins in the drying column and the four nitroparaffins are fractionated at atmospheric pressure with the higher-boiling nonnitroparaffin material removed as bottoms in the final column. Finished nitroparaffins are water-white in color, stable in long storage, and noncorrosive to steel vessels or shipping containers.

Making derivatives . . . The flow sheets of Fig. 2 indicate the preparation of AMP (aminomethylpropanol) and hydroxylammonium sulfate.

- Nitro alcohols are prepared by the condensation of a nitroparaffin and an aldehyde in the presence of catalyst such as sodium, potassium, or calcium hydroxide. Formaldehyde is reacted with 2-nitropropane to make 2-nitro-2-methyl-1-propanol.

- The corresponding amino alcohol is obtained by reducing the nitro group in the nitro alcohol. This is accomplished by hydrogenation with Raney nickel catalyst.

Salts of hydroxylamine are prepared by hydrolysis of a primary nitroparaffin with a strong acid and water. In Fig. 2, the 1-nitropropane is reacted with 100 per cent sulfuric acid in a glass-lined, agitated kettle to make hydroxylammonium acid sulfate. This is reacted in another glass-lined kettle with aqueous 85 per cent methanol to make crystalline hydroxylammonium sulfate. Propionic acid is a byproduct.

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11. Egly, in Joint Symposium on Synthetic Fuels and Chemicals, A.C.S. meeting, Minneapolis, September 12-15, 1955.

How to get top efficiency from refinery burners

- What determines the efficiency of oil and gas burners
- How you can keep efficiency high through maintenance

by Robert D. Reed

MAINTENANCE of equipment in process plants is always an annoying but very necessary evil. However, there are few elements in the operation of the plants which can save more dollars than well-organized and planned programs for maintenance of burners.

How much maintenance is needed? . . . The requirement for maintenance in burners is governed by many factors. For instance . . .

. . . When gas is the fuel, we find these factors are:

1. The corrosive nature of the gas.
2. The temperature level in the furnace.
3. The amount of liquid hydrocarbons carried.
4. The amount of solid matter such as dirt, pipe scale, etc., carried along with the gas.
5. The amount of free hydrogen which is present in the gas.

. . . When oil is the fuel, we find maintenance governed largely by:

1. The corrosive nature of the oil.
2. The amount of solid matter carried in the oil.
3. The amount of condensate present in the steam for atomization.
4. The temperature level in the furnace.
5. The amount of steam for atomization.
6. The temperature of the oil as it is delivered to the burner.
7. The firing-control system which is used.
8. The positioning of the burner in relation to other burner parts.
9. The basic design of the oil burner.

The problems associated with oil burning are almost tremendously more complex than those associated with gas burning. For this reason, we have chosen to make separate discussions of maintenance for the two fuels.

1—Fuel Gases

Fuel gases with rare exceptions are corrosive because of the presence of sulfur compounds such as H_2S and mercaptans. Proper use of alloys will relieve most problems of corrosion. It has been clearly shown that the combination of sulfur compounds with relatively high temperature levels demands an alloy which contains a maximum of chromium and a minimum of nickel

The scaling temperature of the alloy is largely governed by the amount of chromium present. But the rate of attack by sulfur is governed by the percentage of nickel present. Tests have shown that 25-12 is far more resistant to sulfur attack in high temperature than 25-20. The 18-8 alloys at even lower temperature levels have been shown to be unsatisfactory in most cases but much better than carbon steels or cast iron. Straight chromium steels with no nickel present have given excellent service according to the amount of chromium and according to the heat level at the burner.

Liquid hydrocarbons in gases . . . Hydrocarbons as liquids when present in gas burners are particularly aggravating. Coke is formed in and on the burner parts and orifices when the heat level is normal for the burner parts. The burner gets "stopped up." Its heat pattern is upset and the distribution of heat in the furnace suffers. The port stoppage is apt to force operation at reduced heat-release, which means that the quantity of material processed must be reduced.

The presence of liquid hydrocarbons in process gases is becoming rarer as the need for the lighter products increases. Overloaded equipment is usually the cause of the presence of liquids in the gas. If the hydrocarbon occurs in large drops or in "slugs" it is much easier to remove than the finely divided droplets of a fog or mist.

Knockout drums of the tangential-entry type are superior for removal of liquids. At times it is found advantageous to install mist extractors in the gas lines for removal of all liquids before the gas reaches the burners. Any kind of a trap in the gas line will help.

Gas-port stoppage due to solid matter can be extremely aggravating. The solid matter may be almost any kind of debris. Knockout drums will usually trap it, but in the case of a new line or in the case of new construction, the knockout drum can only trap the solids which come from the line up to the drum.

It is becoming more and more common to install fine-mesh strainers in gas lines to trap these solids. The history of such strainers is that they amortize very rapidly. Strainers are installed to the manifold which serves a heater and to individual burners according to preference. Either arrangement is satisfactory, provided the mesh of the strainer is fine enough.

Free hydrogen . . . Process gases in plants which have cat reformers contain increasingly great mole percentages of free hydrogen. There is no evidence that the hydrogen attacks the metal of the burner directly. But there is abundant evidence that the flashback in the burners caused by the free hydrogen in burners of normal premix design can cause great damage to the burners. A further hazard in this condition of flashback is the violence of the detonation upon flashback.

The market now provides premix burners specifically designed to burn high free-hydrogen gases. At times it is possible to convert existing burners to permit perfectly satisfactory burning of the high hydrogen gases. But in some cases, complete change of burners is necessary to get the same satisfactory operation. Consultation with the burner manufacturer on this problem is a step in the right direction.

Heat level in the furnace is a function of the amount of excess air present. Reduced excess air favors fuel economy if the heater and the process will accept increased radiant-transfer rates. The economies of reduction of excess air must be on the basis of increased throughput and fuel savings versus process damage due to excessive transfer rates as well as increased heat damage to the burners.

2—Fuel Oils

Fuel oils, as such, are not great offenders from the standpoint of corrosion unless there is an excess of sulfur compounds or traces of acidic elements. Proper choice of alloys is one

Author is chief engineer, John Zink Burner Co., Tulsa. Paper presented at W.P.R.A. meeting, Casper, Wyo.

solution. But in the case of acidics, monel or Hastelloy may be required for the best solution.

Solid matter in oil is always a serious problem. Port stoppage is one result of the presence of solids and "sparky" or "blobby" fires may well be another. Colloid matter tends to close the passages slowly through control valves to reduce firing rates, then abruptly clear to cause a sudden increase in heat release. Valves of the "vee-port" design are best for colloid matter. Larger suspended solids should be removed through the use of properly designed strainers.

Strainers for fuel oil should be such that the mesh openings are markedly smaller than the minimum passage in the oil burners. Duplex strainers which will permit cleaning without interruption of operation are considered best. The strainer should be at a point in the oil system where the oil is hottest and accordingly at the lowest possible viscosity. Mesh of 1/16 in. has been found satisfactory in most cases, except for the very-small-pressure or mechanical-atomizing burners.

How about condensate? . . . Condensate in steam for atomization tends to accelerate corrosion: to accelerate coking at the tip to cause fires to go out unexpectedly; and to cause the same "sparky" or "blobby" fire which is to be found in the presence of solids.

Correction for the presence of condensate through proper trapping of the steam is the usual practice. A further step in the right direction is to see that all feeders from the steam manifold to burners come from the top of the header rather than from the side or the bottom of the header. Dry steam is very important if steam-atomized burners are to perform well and require minimum maintenance.

One of the peculiarities in the burning of oil is that the temperature level at and before the burner must be higher than is the case when gas is the fuel. Special tile shapes are provided for this purpose, and the air supply is usually regulated to maintain the high temperature.

The presence of the high heat level makes it very important that the oil burner or gun be located in the air register exactly as the manufacturer specifies. He has located the oil gun to provide a maximum of cooling and a maximum of protection from heat. Such a location minimizes maintenance on the burner.

Delivered oil temperature . . . The temperature of the oil as it is delivered for burning is very important from both the maintenance and operating standpoint. Oils to be burned properly should be heated to provide viscosity as burned, which ranges from 20 to 25 S.F.s. or from roughly 32 to 50 cp. The viscosity is to be as taken at the burner and not at a heating and pumping set at a point remote from the heater.

Heat loss from fuel-oil lines is a very important cause of burner maintenance. Oil properly heated at the pump and heat exchanger gets chilled en route to the burner. Its viscosity rises to a point which prohibits good atomization. Poor atomization causes the tip to become "wet" with oil; excessive coking on the tip; and a smoky, sparky, blobby fire.

A consensus of authorities very strongly favors the use of a "loop" or circulating fuel-oil system in which the total volume of oil flowing is not less than three times the maximum volume of oil burned. The same authorities strongly favor very careful insulation of the loop.

If, despite careful insulation of the loop, there is excessive heat loss, it may be found profitable to install auxiliary heat-exchangers along the loop to maintain proper oil temperature. The latter expedient is recommended for very cold climates.

Fuel oil pumping . . . A further point for consideration in the elimination of excessive maintenance lies in the selection of the pumping equipment which is to deliver fuel oil to the loop. Steady, pulsationless, fuel-oil pressure is demanded for best operation of oil burners.

Rotary pumps have been found quite satisfactory for fuel-oil service. In some cases, surge chambers of proper design are of major help where a reciprocating pump must be used. Means for restoration of the air pad in the surge chamber must be provided. Such surge chambers are now commercially available.

The firing control system for the burning of oil must be considered carefully if the ratio of oil to steam is to be preserved. Most manufacturers design their oil burners around the idea of a fixed differential pressure between the steam and the oil. A system designed to hold the specified differential will usually prove satisfactory.

Such a system does not make provision for change in viscosity of the fuel oil. Therefore, the system for heating the fuel must be capable of maintaining fixed viscosity when the fuel oil is changed.

It may be found that the basic design of the oil burner must be changed in order to meet specific plant conditions. Generally speaking, it is the intent of the manufacturer to provide a rather wide range of tolerance for change in oil conditions. At times the range is not great enough. If there is persistence of coking and heat attack in oil burners, the manufacturer should be consulted.

BOOK

BAKER RETAINER PRODUCTION PACKER. Published by Baker Oil Tools, Inc., 7400 E. Slauson Avenue, Los Angeles 54. 72 pp.

Here's a comprehensive, instructive, 72-page manual devoted solely to the use of a single oil tool—a permanent-type production packer. Its six sections cover virtually every engineering and operating detail that drilling supervisors as well as drilling engineers need to know about the design and use of this relatively new type of packer.

Almost half of the manual is devoted to a fully illustrated explanation of operating instructions, procedures, and applications for this type of packer. Starting with detailed procedures to be followed before running or setting the packer, the manual goes on to describe: (1) how to run and set the packer on wire-line tubing or drill pipe; (2) how to bring a well into either single or dual-zone production; (3) how to work over zones below the packer by cementing, acid squeezing, and fracturing and by cleanout and perforating; (4) how to work over zones above the packer by use of plugs, tubing seal nipple receptacle hookups with valves; (5) how to pull the tubing when there is pressure between casing and tubing; and (6) methods to dispose of the mud between casing and tubing and to drill up the packer in either rotary or cable-tool operation.

The basic production applications of the packer are described as: (1) single-zone production; (2) dual-zone production, single-packer installation; (3) dual-zone, crossed-flow, two-packer installations; and (4) permanent-type well completions.

The packer's applications are also described for testing acid squeeze, fracturing, or squeeze cementing; water flood or gas injection; isolation of the annulus; bridge plugs; and such special applications as offshore installations.

The value of these descriptions of procedures and applications lies in the clear but detailed way they are written and the highly effective way they are illustrated. All procedures are described in step-by-step, numbered sequences and two and three-color illustrations are used when needed to clearly show the operation described.

The manual also covers the packer's mechanical features and describes how it works and what safety factors are incorporated in its design. One section is devoted to the accessories used with the packer, and another covers technical specifications and instructions for ordering the equipment to fit the specific job.

In all, this manual will prove a useful, informative reference source for operating personnel now using this type of equipment and for those who contemplate using it in the future.

JOB IMPROVEMENT FOR THE PROCESS FOREMAN—37

Nine Questions and Answers on Mechanical Seals

Q. What is a mechanical seal?

A. A mechanical seal is a combination of parts that, when properly applied, prevent leakage between a rotating and a stationary member of a piece of equipment.

Q. How is this done?

A. One part or group of parts is positioned on the shaft in such a way that there will be no leakage between the part and the shaft. Another part or group of parts is positioned into the stationary member through which the shaft operates. This prevents leakage between the part and the stationary member. The rotating and stationary parts are held together in sealing contact so that there will be no leakage between the two. The contracting surfaces must match each other and the materials must be such as to run together with minimum friction and therefore minimum wear.

Q. How are the matching surfaces prepared?

A. The only type of surface that will interchangeably match another surface is a perfectly flat one. Seal contact faces are lapped to optical flatness. The term "optical flatness" refers to a degree of perfection that is readily and accurately measured by optical means to millionths of an inch.

Q. What method is employed to keep the faces in contact?

A. One of the parts (either rotating or stationary) is energized axially by means of a compression spring. This spring is designed and positioned to produce the correct "face pressure" for adequate sealing contact and, at the same time, produce minimum "drag" or friction at these faces.

Q. What factors determine, the correct face pressure?

A. The correct face pressure is that degree of force which will allow the fluid being sealed to penetrate between the faces and provide a lubricating film, but which will not allow this film to progress completely through, which would represent leakage. Factors affecting this ideal film condition and hence the required "face load" are: (1) surface finish of the faces; (2) flatness of the faces; (3) viscosity of the fluid; (4) axial vibration characteristics of the unit; and (5) forces interfering with free axial movement of the spring actuated part (seal ring), such as packing friction and mass of the seal ring.

Q. In what way do each of these factors affect the film thickness between the faces?

A. . . . **Surface finish.** A seal surface having scratches will provide paths for the fluid to enter that will have greater dimension than if the scratches were not present.

. . . **Flatness.** Any deviation from perfect flatness will allow localized paths of greater dimension than perfectly flat faces would allow.

. . . **Viscosity.** Film strength or resistance to thickness reduction through squeezing is closely allied to viscosity. The higher the viscosity, the more pressure is required to force a fluid through a space or orifice of a given dimension.

. . . **Axial vibration.** Vibration in the sealed unit will tend to separate seal faces by "throwing" the seal away from its mating surface, thereby allowing the formation of a thicker film.

. . . **Forces interfering with free axial movement.** After seal faces have been thrown open by vibration, any force or condition that will retard reclosing will tend to maintain excessive face opening and hence excessive film thickness. Packing friction can delay the return movement of the seal ring. Also, the mass of the seal ring, having been energized in one direction, must be decelerated and energized in the opposite direction to maintain face contact and optimum film thickness.

Q. Is the spring the only means of maintaining face contact?

A. No. A properly engineered seal uses the fluid pressure of the medium being sealed to augment the spring force. This is done by so controlling the radially extending areas acted on by the fluid that the resulting force acts to move the seal ring toward its mating surface. A "balanced" seal has this condition controlled to a degree that results (1) in face pressures that are proportional to fluid pressures and (2) in an optimum range for the type of fluid being sealed, thereby maintaining correct film thickness between faces.

Q. How are the revolving parts sealed to the shaft?

A. If the revolving part need not move axially, it may be loose on the shaft with a packing such as an "O" ring between it and the shaft and located by an axial abuttment on shaft. (Bearings, shoulder, snap rings, etc.)

If the revolving part is required to move axially, the ring must be loose on the shaft with a packing between it and the shaft. If a shaft sleeve is used, the ring would be sealed to the sleeve and the sleeve sealed to the shaft.

Q. What is the preferred method?

A. The loose fit with separate packing member is preferred, chiefly because this results in minimum possibility of distortion of the seal ring face. When parts are a loose fit on shaft, means must be provided to ensure rotation of the ring (except in those cases where rubber packing friction suffices).

Note: Seals mounted on rotating shafts through rubber elements are limited as to acceptable rotative speed.

Dowell engineers use thickened crude oil with low fluid loss in Petrojel fracturing treatments.

DOWELL TREATMENT CARRIES SAND FARTHER INTO FRACTURES

PETROJEL*, an exclusive Dowell service, uses your own lease crude, diesel fuel or kerosene to give you an economical, efficient fracturing treatment.

The oil is mixed with special thickening agents in Dowell truck-mounted tanks or in your own lease tanks. The resulting Petrojel fluid has lower surface tension than the original base oil. This makes formation penetration and return of the fluid to the well bore easier. No gel-breaker is required. Additives also control fluid loss and oil thickness permitting sand to be carried farther into the fractures. The result—greater production.

What's more, Petrojel resists thinning at temperatures up to 200° F., making it especially effective in high temperature wells. You can use low treating pressures with Petrojel, too. Field use has shown it requires 500 to 2000 p.s.i. less pressure than other fracturing media when pumping through tubing.

For more information or service, call any of the 165 Dowell offices in the United States and Canada; in Venezuela, contact United Oilwell Service. Or write to Dowell Incorporated, Tulsa 1, Oklahoma, Dept. A-11.

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services for the oil industry

DOWELL

A SERVICE SUBSIDIARY OF THE DOW CHEMICAL COMPANY

by Ovid Baker
and
Will Swerdloff

CALCULATION OF SURFACE TENSION—7

Three Methods for Finding Surface Tension

This is the final installment of this series. Those who would like to get a free reprint of the series can do so by writing to the authors in care of Magnolia Petroleum Co., P. O. Box 900, Dallas 21.

Method 2[15*]

1. Tabulate the weight per cent or volume per cent of each component in the mixture.

2. Read the surface tension in dynes per centimeter for each component at the temperature of the liquid. These data should be read from Fig. 1*. Some components may show a zero surface tension at the liquid temperature. Use this zero value for this calculation.

3. Multiply the surface tension of each component by its percentage composition and add up the products. Divide the sum by 100 per cent to obtain the surface tension of the mixture.

4. Comparison of the three methods on a deethanizer reflux gave:

	Dynes per cm.
Method 2	8.35
Method 3	7.20
Method 4	6.27

Method 3[15,27]

1. Tabulate the mole per cent of each component in the liquid.

2. Tabulate the critical temperature (degrees Rankine, °F. + 460) for each component and multiply the critical temperature for each component by its mole percentage.

3. Add the products and divide by 100 mole per cent to get the pseudo critical temperature, pTc.

4. Obtain the molecular weight of the liquid and read the equivalent critical temperature, Te, from Fig. 10.

5. Calculate the ratio Te/pTc. If the liquid contains more than 5 mole per cent methane and lighter obtain the corrected Te/pTc from Fig. 11.

6. Read the true critical temperature, Tc, from Fig. 12.

7. Read the surface tension, dynes per centimeter, from Fig. 13.

Method 4[5,16,17]

1. The equation used for this calculation is:

$$\gamma^{1/4} = P_1[X_1(d_L/M_L) - Y_1(d_V/M_V)] + P_2[X_2(d_L/M_L) - Y_2(d_V/M_V)] \ldots + P_n[X_n(d_L/M_L) - Y_n(d_V/M_V)]$$

Where:

γ = surface tension, dynes per centimeter
P = parachor for the component
X = mole fraction of the component in the liquid phase
Y = mole fraction of the component in the vapor phase
d_L = density of the liquid phase at the system temperature and pressure, grams per milliliter
d_V = density of the vapor phase at the system temperature and pressure, grams per milliliter
M_L = average molecular weight of the liquid phase
M_V = average molecular weight of the vapor phase

Subscripts 1, 2, ... n refer to Component No. 1, No. 2, and all components to the last or Nth component of the mixture.

2. Tabulate the mole per cent of each component in the liquid phase

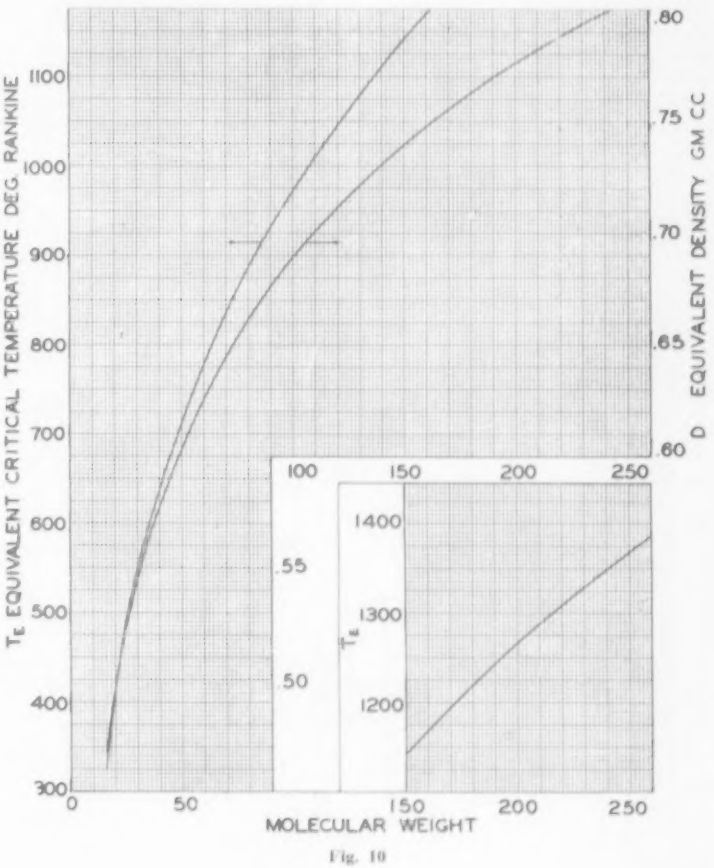


Fig. 10

*All figures and references other than these presented here were published in previous installments.

Authors are with natural gas department, Magnolia Petroleum Co., Dallas.

and the mole per cent of each component in the vapor phase.

3. At the equilibrium temperature and pressure of the system calculate the density of the liquid mixture, the density of the gas mixture, the average molecular weight of the liquid phase, and the average molecular weight of the gas phase.

4. Calculate (d_L/M_L) and (d_V/M_V) or moles per milliliter for the liquid and vapor mixtures.

5. Tabulate $(d_L/M_L)X$ and $(d_V/M_V)Y$ for each component.

6. Tabulate the quantity $(d_L/M_L)X - (d_V/M_V)Y$ for each component.

7. Multiply

$$[(d_L/M_L)X - (d_V/M_V)Y]$$

for each component by its parachor and add up the products. Sometimes the products of the lighter components will be negative. Parachor values are given in Table 3 and Fig. 2.

8. The sum of the products in Step 7 is raised to the fourth power to give surface tension to dynes per centimeter.

Laboratory Determination

Many oil company and commercial laboratories have facilities for determining surface tensions experimentally in cases where the estimating methods outlined are not satisfactory. Values for stock-tank oils or other liquids at atmospheric pressure can be determined easily. High-pressure samples require elaborate preparations and should be arranged for some time before the data are needed.

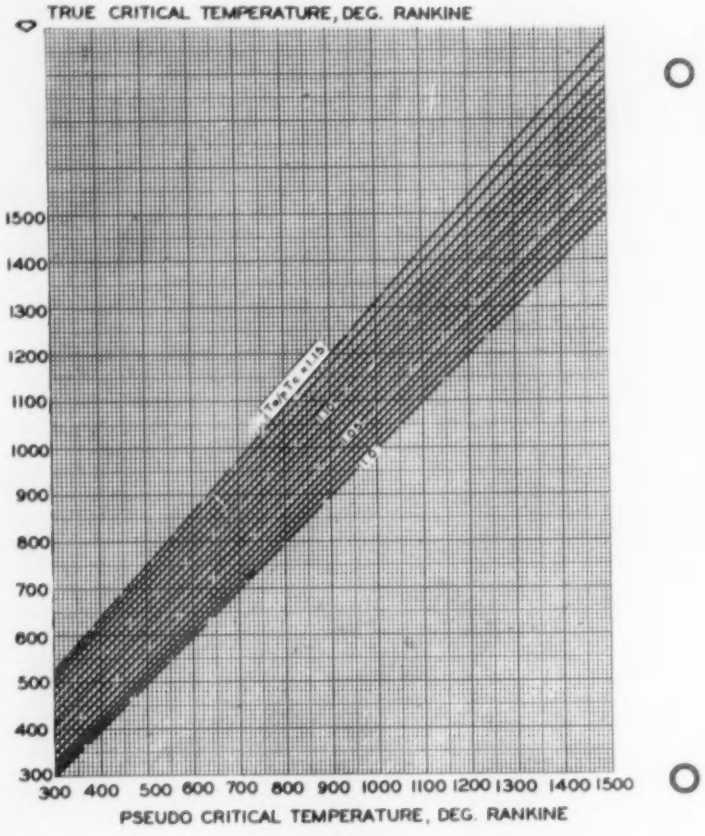


Fig. 12

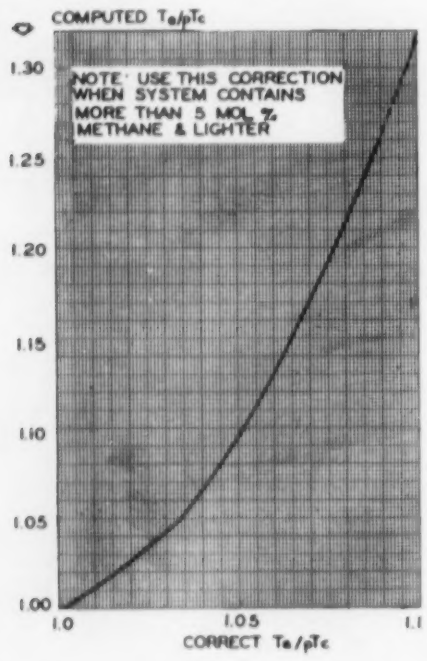


Fig. 11

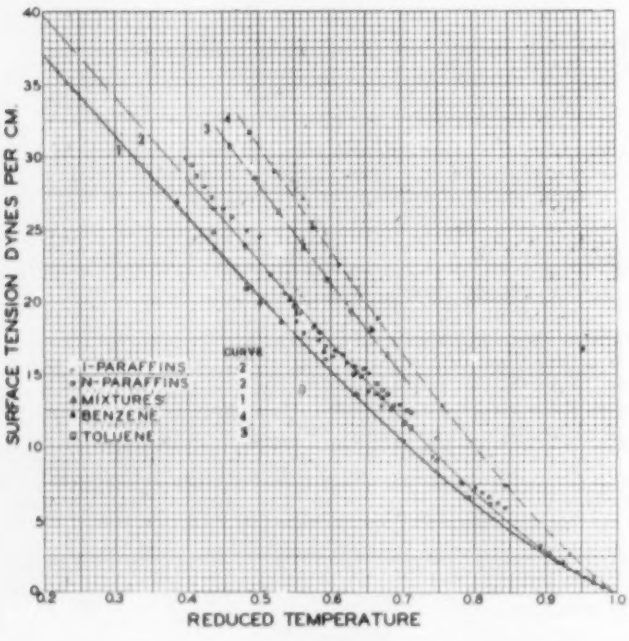


Fig. 13

by W. L. Nelson
Technical Editor

COST-imating

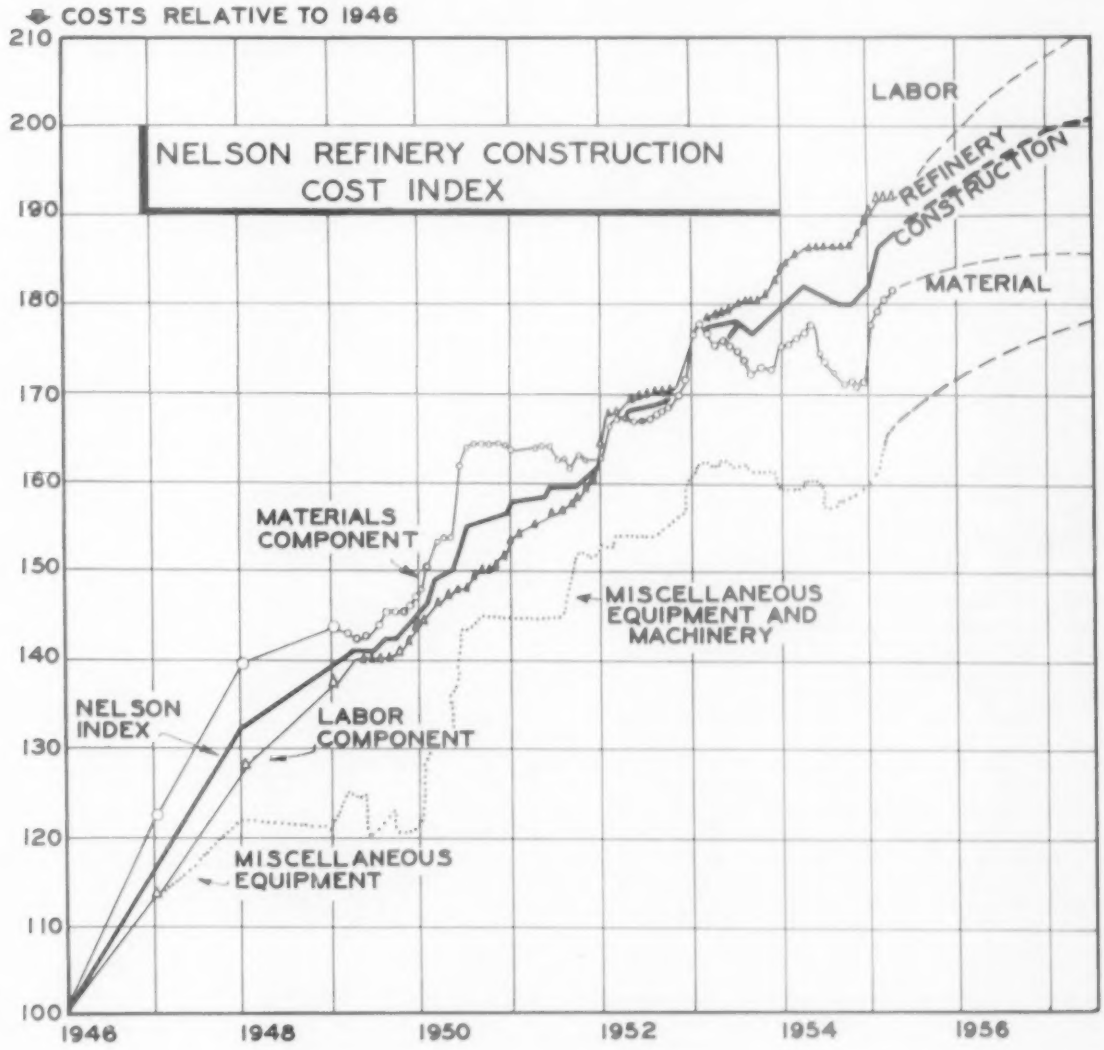
Refinery Construction Costs Continually Rise

THE cost of refinery construction except during a short period during the last of 1954 and early 1955, has risen continually since 1946. Material costs increased more rapidly than the cost of labor until mid-1952, but thereafter labor costs have been the main reason for advances.

The Korean War during 1950 caused the first sharp increase in material costs but later sharp increases have been precipitated by wage increases. It will be noted that wage increases during June-August 1952 preceded the general cost rise and likewise during May-August 1953. The increase in steel workers' wages (June 1954) is not indicated on the accompanying chart but its effect on steel prices and the cost of refinery construction is clearly evident during the period of June-September 1955.

Manufacturers of equipment and machinery (pumps, compressors, engines, instruments, heat exchangers, and electrical equipment) seem to have been able to overcome higher labor and raw materials costs by improved management and design. Note the modest increases in the cost of Miscellaneous Equipment.

Barring such emergencies as severe curtailment of business, wars, or political upheavals, it appears that refinery construction costs will rise throughout 1955-1957 to a value twice the cost of construction in 1946. Even though the cost of labor is expected to rise, there should be only a modest increase in cost of materials.



by W. L. Nelson
Technical Editor

QUESTIONS ON TECHNOLOGY

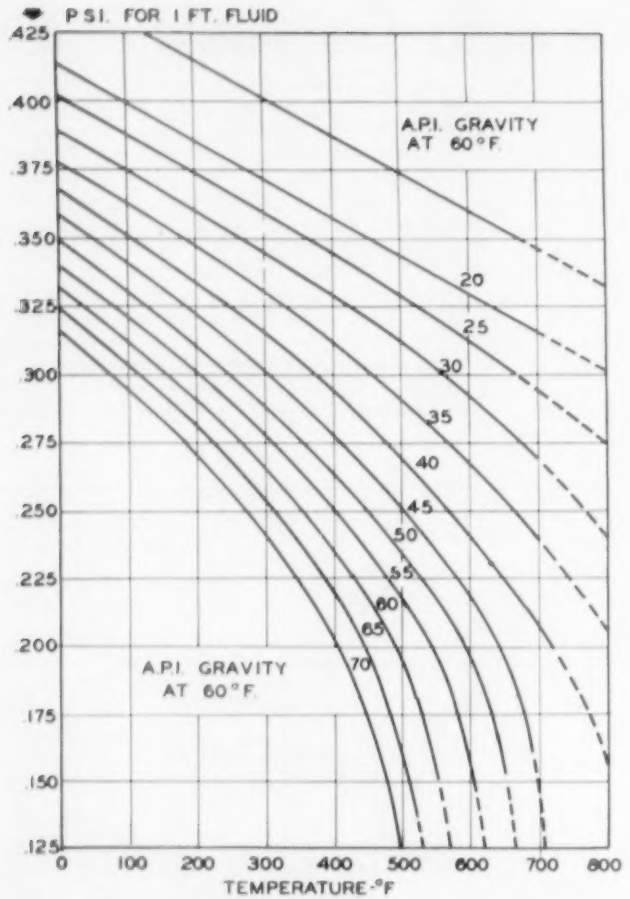


Fig. 1—Head of oils as a function of A.P.I. gravity and temperature.

Gravity Versus Fluid Head

Do you have a chart or slide rule that will convert a static head of A.P.I. gravity oil (10°-40° A.P.I.) from pounds to feet?—R.H.H.

We know of no such chart or slide rule and the lack of data is probably due to the fact that temperature is a third variable that cannot be neglected. Furthermore, the effect of temperature in decreasing the density of an oil is different for different types of oil (i.e., paraffinic or naphthenic). There are, however, numerous charts of the specific gravity of oils as a function of temperature, as Fig. 49, page 158, of the third edition of Petroleum Refinery Engineering (McGraw-Hill Book Co., Inc., New York, 1949).

Specific gravity can, of course, be converted to "pounds per square inch" per "foot of fluid":

$$\text{psi.} = \frac{\text{Sp. gr.} \times 62.4 \times 1\ (\text{ft.})}{144}$$

This has been done using the data of Fig. 49 referred to above, and Fig. 1 on this page is the result.

Index of Rotary Drilling Costs

We note your drilling equipment costs of October 10, 1955. Is there an index of drilling costs similar to your Nelson Refinery Construction Index?—J.B.B.

An index somewhat similar to the Nelson Index is prepared by the American Association of Oil Well Drilling Contractors. It is made up of the costs of equipment, miscellaneous items, and labor in the proportions of 51, 3, and 46 per cent and applies to rotary-drilling costs. Values of this index are shown in Table 1 along with the refinery index for comparison.

Quite different indexes are indicated by other sources of information such as H. J. Struth (Pet. Eng., May 1953, page A69) who shows indexes of per foot drilling costs for exploratory wells as only 34.9 for 1941 (against 75.7 here) and only 113 in 1952 (against 144 shown here).

TABLE 1—APPROXIMATE INDEX OF ROTARY DRILLING COSTS BASED ON 1946 AS 100

Year	Rotary drilling costs*				Refinery construction costs index (Nelson)
	Labor	Equipment	Miscellaneous	Total	
1941	69.3	83.0	71.4	75.7	80.0
1942	76.3	85.1	75.0	79.5	83.7
1943	83.2	87.2	78.5	84.0	86.6
1944	90.1	89.3	82.2	88.7	88.1
1945	97.1	91.3	85.7	92.7	89.9
1946	100.0	100.0	100.0	100.0	100.0
1947	104.0	109.5	114.2	109.9	117.0
1948	117.2	120.2	117.2	122.0	132.5
1949	124.2	132.8	120.8	129.1	139.7
1950	132.0	144.3	124.3	137.4	146.2
1951	135.3	149.3	129.3	141.7	157.2
1952	135.7	151.4	131.5	144.0	163.6
1953	137.0	155.0	133.7	145.8	173.5
1954	138.9	157.6	137.2	147.4	179.8
1955 est.	140.3	160.7	138.0	149.6	185.0

*American Association of Oil Well Drilling Contractors.

Pipeline Patrol

. . . Report on Construction

Under Way, Contracted, and Planned

PIPELINE activity as reported below by The Oil and Gas Journal is compiled from information received from pipeline companies and contracting firms.

These projects include those planned, proposed, under way, and contracted. Uncontracted projects are indicated by • preceding the job.

Crude-Oil Pipelines

• **Big Horn Pipe Line Co.**—Firm has asked Wyoming Public Service Commission for permission to build a 150-mile, 8-in. crude-oil line from Ash Creek field, Wyoming, to a connection with Service Pipe Line Co.'s line at Midwest, Wyo.

Lakehead Pipe Line Co., Inc.—Company has let 51 miles of 26-in. line to Anderson Brothers Corp., Houston. The job is expected to be completed during the summer of 1956 and is in conjunction with 69 miles of 24 and 26-in. looping that Interprovincial Pipe Line Co. will also complete next summer (see Interprovincial under Canada, also).

• **Offshore Gathering Corp.**—This Houston company has proposed to build a natural-gas and a crude-oil line to gather gas and crude in the Gulf of Mexico off Louisiana. The gas line will be comprised of 60 miles of 24-in., 70 miles of 26-in., and 234 miles of 30-in. The crude line will be mostly 20-in. Each line will be about 364 miles in length. Estimated cost of the lines is $150,000,000.

• **Sinclair Pipe Line Co.**—Company will build a 300-mile crude line form Jacksboro, Tex., to Houston. The project will cost $14,000,000 and require 3 years to complete. The 150-mile portion from Jacksboro to Mexia will be 18-in. pipe. The Mexia-Houston portion will be 20-in.

• **Union Oil Co. of California.**—Company proposes to build an 815-mile line from Rifle, Colo., to Los Angeles to carry the products from its proposed Rifle, Colo., shale-oil plant to the Los Angeles refining area. The line would cost approximately $56,000,000.

• **U. S. Defense Department.**—Defense officials are considering a 97-mile, $8,000,000 line from the Elk Hills Naval Reserve in California to the Los Angeles refining area.

• **West Coast Pipeline Co.**—The off-again-on-again plans for this crude line from near Wink in West Texas to near Norwalk in California are presently before the Office of Defense Mobilization. A three-man board of nonindustry members has recommended that the project be dropped. They questioned the ability of West Texas to produce enough crude to supply both the East and West Coasts in time of war. The three-man board favored building a line from California's Elk Hills Naval Reserve to be held in standby for possible future need.

Products Pipelines

• **American Pipe Line Co.**—Has received ODM approval to amortize 40 per cent of $178,000,000 with a rapid writeoff on proposed line to run from Gulf Coast area to New York City area.

• **H. W. Bass & Sons, Inc.**—Company is planning on a 152-mile, 4-6-in. L.P.G. line from Goliad Corp.'s plant in Live Oak County, Texas, to Corpus Christi.

• **Cosden Petroleum Corp.**—Company will build 100 miles of 6-in. line from its refinery at Big Spring to Abilene, Tex.

• **Gulf Refining Co.**—Firm will build a 45-mile, 8-in. products line from Pontiac Eastern Corp.'s planned refinery at Hattiesburg, Miss., to a connection with Plantation Pipe Line Co.'s system. The refinery isn't due on stream until May 1957, and no definite time has been set for start of laying the line.

• **International Pipe Line, Inc.**—132 miles 8-in., proposed, Wrenshall to Minneapolis, Minn. Cost $4,200,000.

• **Phillips Chemical Co.**—Firm plans a 50-mile, 4-in. ethylene line from Sweeny, Tex., to Port Adams, Tex. The estimated date of completion is set for October 1, 1956.

• **Phillips Pipe Line Co.**—Firm plans 64-mile, 12-in. products line from Sweeny to Houston. Completion set for April 1956.

• **Phillips Petroleum Co.**—Firm has bids out for 40-mile, 4-in. gasoline line from Lindsay, Okla., to Oklahoma City. Completion set for last of January 1956.

Plantation Pipe Line Co.—Firm will spend $23,500,000 in 1956 to expand its system from Baton Rouge, La., to Greensboro, N. C. The company will lay 327 miles of 18-in. from Baton Rouge to just south of Birmingham at Helena, Ala. The new line will increase capacity from 245,000 bbl. daily to 304,000 bbl.

• **Sioux Oil Co.**—Firm plans to build 80-mile, 4½-in. line from its Newcastle, Wyo., refinery to Rapid City, S. D. The line is slated for completion in late 1956.

• **Sun Pipe Line Co.**—Firm will build 110 miles of 14-in. from Twin Oaks, Pa., to Newark. The line will have a 83,000-bbl. capacity and will replace an existing 8-in. line. September 15, 1956, is expected completion date.

• **Sunflower Pipe Line System.**—Company proposes to build a 215-mile, 6-in. line to transport L.P.G. from six counties in western Kansas to Wichita. Application approved by Kansas Corporation Commission.

Texas Eastern Transmission Corp.—Company has received Federal Power Commission approval to abandon the "Little Inch" gas line and to convert it to products service. The company will spend $13,000,000 converting the line back to products. When finished the line will have a capacity of 235,000 bbl. daily.

Non-Petroleum Pipelines

American Gilsonite Co.—Company has announced plans for a 100-mile pipeline from near Bonanza, Utah, to a proposed gilsonite refinery in western Colorado. The company, owned by Barber Oil Corp. and Standard Oil Co. of California, plans to make gasoline and coke by refining gilsonite. The gilsonite would be moved in a slurry.

Pittsburgh Consolidation Coal Co.—This firm has announced plans for the first pipeline to move coal. The line will be 108 miles of 10-in. from the company's Georgetown mines in eastern Ohio to Cleveland Electric

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Illuminating Co.'s Eastlake power plant northeast of Cleveland. Ford, Bacon & Davis, Inc., will issue specifications, let contracts, and supervise the construction work. Williams Bros. has contract and has shut down for the winter.

Natural-Gas Pipelines

American Louisiana Pipe Line Co.—Company has let bulk of its 1,121-mile line from North Tepetate, La., to Detroit. Only a 22-in. spur from Payne, Ind., to Bridgman, Mich., is still not awarded. H. C. Price Co., Bartlesville, Okla., has 783 miles of 30-in. pipe. One section will work south from the Hancock-Henry County line and the other will work north from Slaughters, Ky. Brown & Root has 221 miles of 30-in. from North Tepetate to the Louisiana-Arkansas border, and 39 miles of 16-in. line to be built under water. The firm has subcontracted the 221 miles to Associated Pipe Line Contractors and Western Contractors. It will lay the under-water line itself.

• **Carolina Pipeline Co.**—This newly organized firm has applied to the South Carolina Public Service Commission for permission to distribute natural gas in central South Carolina. The firm plans to build $8,700,000 worth of distribution lines to 14 cities. Other towns in the area without natural-gas service may be included eventually. The new firm plans to buy gas from either Transcontinental Gas Pipeline Co. or Southern Natural Gas Co.

• **Carolina Natural Gas Corp.**—185 miles 8-12-in., proposed lateral lines off Transcontinental in North and South Carolina.

• **Cities of Clarendon and Marvell, Ark.**—Cities have filed for FPC permission to interconnect their facilities with Texas Gas Corp.'s line south of Helena, Ark. The cities will build 53 miles of 4, 5, and 6-in. line to transport the gas.

• **Coastal Transmission Co.**—Company plans to build 550 miles of 30-in. line from near McAllen in South Texas to near Baton Rouge (See Houston, Texas Gas & Oil Co.)

• **Colonial Natural Gas Corp.**—Company proposes to build two systems, one from the Houston-Lake Charles area to Miami, Fla., and the other in the Carolinas and Georgia. Neither idea is before the FPC yet.

• **Colorado Interstate Gas Co.**—Firm completed 136 miles of 22-in. from Laramie, Wyo., to Denver in November. Second part of line from Laramie to Rock Springs, Wyo., will be laid in 1956. The second section will be 238 miles of 22-in. pipe and will be completed about October 1.

• **El Paso Natural Gas Co.**—Firm has received FPC permission to loop 450 miles of 34-in. line from the San Juan basin to the Colorado River at the Arizona-California border.

• **Houston Texas Gas & Oil Co.**—Company has applied to FPC for permission to lay a 960-mile gas line between Baton Rouge and Miami. The main line would consist of 507 miles of 30-in., 157 miles of 26-in., 61 miles of 20-in., 224 miles of 18-in., and 12 miles of 12-in. Company also plans 500 miles of sales laterals in Florida. Main line would join with Coastal Transmission's proposed line from McAllen to Baton Rouge.

• **Iron Ranges Natural Gas Co.**—This St. Paul company has filed an application with the FPC to build a 68-mile transmission line and 47 miles of laterals to supply various towns and cities on the Mesabi Iron Range in Minnesota.

• **Lone Star Gas Co.**—Company has two plans up before FPC to enlarge its system in Texas and Oklahoma. One is for an $18,000,000, 230-mile line from Cotton County, Oklahoma, to Fritch, Tex. The other plan is for a 205-mile line from Snyder, Tex., to a hookup with the Cotton-Fritch line. The company hopes to prevent Natural Gas Pipeline Co. of America from building its line from Wise County, Texas, to Fritch (see below).

• **Michigan Consolidated Gas Co.**—25 miles, 12-in., proposed, from near Sparta to Muskegon, Mich.

• **Michigan Wisconsin Pipe Line Co.**—251 miles, proposed, 24, 18, 12, 6, and 4-in. loops. Majority will be in Wisconsin.

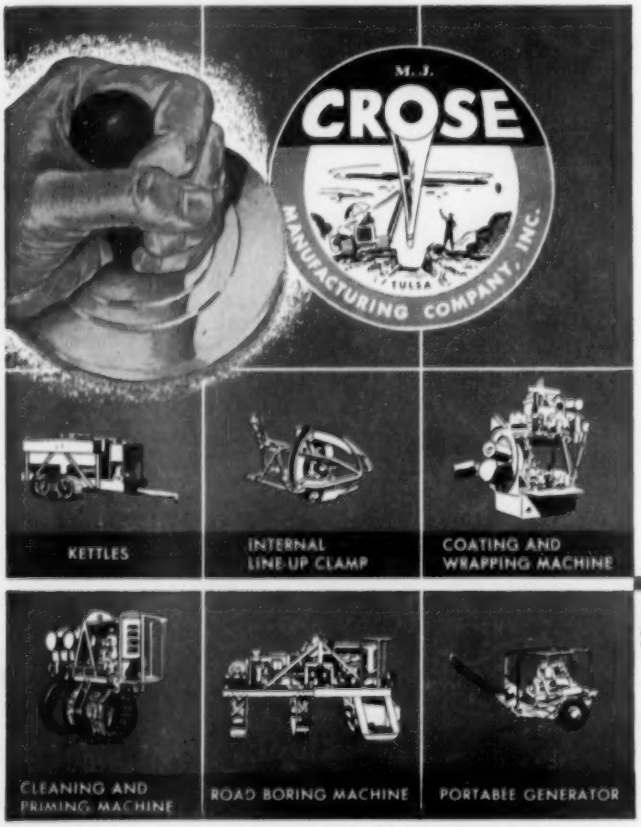
• **Midwestern Gas Transportation Co.**—Company will build a main line from Portland, Tenn., to Canadian border near Emerson, Man., Canada. Extensions from main line to cities in Minnesota and Wisconsin are also planned. The main line will be comprised of 829 miles of 24-in., 109 miles of 16-in., and 174 miles of 12-in. The extensions will total 648 miles of 3 to 18-in. pipe. The application is now pending with the FPC.

• **Natural Gas Pipeline Co. of America**—Company now before FPC on plans to build 150 miles of 20 and 26-in. line from Wise County, East Texas, to its station 111 at Fritch, Tex.

Nevada Natural Gas Co.—Company plans looping program along its 114-mile line from Needles, Calif., to Las Vegas, Nev. Mileage and size are unknown but cost will be about $2,500,000.

• **New River Gas Co.**—50 miles, planned. Summers to Monroe counties, West Virginia to Narrows and Dublin, Va.

• **North Carolina Natural Gas Corp.**—This subsidiary of Colonial Natural Gas Corp. (formerly Texas-Ohio Gas Co.) has received permission from the North Carolina Utilities Commission to build 575 miles of gas lines in the state. The system will range



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in size from 3 to 16-in. and will cost about $13,000,000. The line will run from a point on Transcontinental Gas Pipe Line Corp.'s system near Mooresville, eastwardly across North Carolina. It will deliver gas to customers in a territory lying east of Charlotte and south of Lexington, Sanford, and Raleigh.

• **Northern Natural Gas Co.**—Company plans to spend $32,000,000 to add 348 miles of main line and 307 miles of branch lines in Wisconsin, Minnesota, South Dakota, and Iowa. The application is before the FPC now. The main lines include 169 miles in the Duluth-Superior area and 164 miles in the Aberdeen area of South Dakota.

• **Pacific Gas & Electric Co.**—Company's long-range plans call for looping the Topock-Milpitas line with 135 miles of 34-in. The major part of the line will be laid in 1956, while 62 miles will be laid in 1957.

Pacific Northwest Pipe Line Corp.—Firm has let the initial contracts of its 1,446 miles gas line from the San Juan basin to Bellingham, Wash. The first contracts total $11,236,000. Contractors and their sections are:

River Construction Corp., two sections totalling 150 miles of 26-in. between Ignacio, Colo., and Moab, Utah.

R. H. Fulton Co., two sections totalling 160 miles of 26-in. between Moab and Jensen, Utah.

Associated Pipeline Contractors, Inc., one section of 77.6 miles of 26-in. between Jensen and Green River, Wyo.

A. J. Curtis Construction Co., one section of 82.8 miles of 22-in. from Green River to Sage, Wyo. Completed.

B & M Construction Corp., one section of 90 miles of 22-in. between Sage and Lava Hot Springs, Idaho.

Midwestern Constructors, Inc., one section of 95 miles of 22-in. from Hot Springs to Burley, Idaho.

H. B. Zachry Co., San Antonio, sections 9 and 10, 214 miles of 22-in. between Burley and Payette, Idaho.

Fulghum Construction Co., Harrisburg, Pa., sections 11 and 12, 198 miles of 22-in. between Payette and the Columbia River at the Oregon-Washington border.

A. J. Curtis Construction Co., Casper, section 26, 54 miles of 16-in. laterals and 31 miles of gathering-system lines from a point on the main line near Kemmerer, Wyo., to Big Piney field, Wyoming.

R. H. Fulton, Lubbock, section 27, 43 miles of lateral lines and 16 miles of gathering lines from Rangely, Colo., to Piceance Creek field, Colorado.

Phillips Petroleum Co.—Vaughn & Taylor has contract for 120 miles of 2 through 30-in. gas gathering lines in Garvin, Grady, and McClain counties of Oklahoma. Job will be finished in January of 1956.

• **Pine Tree Natural Gas Co.**—204 miles of undetermined size pipe to run from the Boston area to Bangor, Me.

Private Interests.—Proposes to build gas line from Gubik gas field near Navy Petroleum Reserve No. 4 in Alaska to Fairbanks. Line would be 450-mile, 8-in. line and Arctic Contractor, Inc., who handled engineering requirements and preliminary design, estimated the line would cost $20,000,000, although later figures have been much higher than this.

• **Southern California Gas Co.** and **Southern Counties Gas Co. of California.**—Firms have plans for three separate jobs. First is 19 miles of 30-in. from Placentia to Compton, Calif. Completion set for November 1956. Second job is 70 miles of 30-in. from Palmdale to Alhambra, Calif., and completion is slated for November, too. Third job is 210 miles of 30-in. from Topock to Palmdale. Last job not expected to be finished before April 1957.

• **Southern Natural Gas Co.**—Company has temporary FPC authority to build 39 miles of loop lines and add 4,950 hp. to its compressor power near Atlanta, Ga. Job will cost about $2,000,000.

Tennessee Gas Transmission Co.—The firm has the following projects under way or planned.

Project 1—370 miles of 30-in. line from Agua Dulce, Tex., to Kinder, La. Contractors are Morrison Constructors, Inc.; Williams Bros.; Houston Contracting Co.; H. C. Price Co.; Western Constructors; N. A. Saigh Co.; Panama-Williams Co.; and Associated Pipe Line Constructors, Inc. Completed.

Project 2—250 miles of 24-in. from Coudersport, Pa., to Greenwich, Conn. Contractors are H. C. Price, Bechtel Corp., and Pentzien, Inc. Completed.

Project 3—147 miles of 26-in. and 74 miles of 30-in. Thirty runs from Cave City, Ky., to Danville, Ky. Twenty-six-inch runs from a point north of the Ohio River to McConnellsville, Ohio, and from Newcomerstown, to near Lisbon, Ohio. Approved by FPC but not yet contracted. Completion set for fall of 1956.

Project 4—192 miles of 24-in., 34 miles of 20-in., 15 miles of 18-in., and approximately 110 miles of 4, 6, 8, 10, and 12-in. from point west of Crowley, La., looping the Bayou Sale gathering line for a distance of 74 miles to a point near the mouth of the Mississippi River. Job not yet contracted. Completion set for summer of 1956.

Project 5—63 miles of 30-in. and 99 miles of 26-in. Thirty-inch will run from Scottsville, Ky., to Cave City, Ky., and from point southwest of Danville, Ky., to a point northeast of Danville. Twenty-six-inch will run from near Greenup, Ky., to just north of the Ohio River; from McConnellsville to near Newcomerstown and from Lisbon to Mercer, Pa. Application pending with FPC.

Project 6—Approximately 100 miles of 4, 6, 8, 10, and 12-in. gathering lines in the Gulf Coast area of Texas and Louisiana. Application pending with FPC.

(For news of a Tennessee subsidiary see Midwestern Gas Transmission Co.)

Texas Eastern Transmission Co.—Company has received FPC permission to begin converting its Little Inch line from natural gas to products service. Company has also proposed to Mobilization Director Arthur S. Flemming that the Government give it accelerated amortization on money to invest to put the Big Inch line on standby product service. The company's program is:

. . . To convert the Little Inch to products with a capacity of 235,000 bbl. daily and to install enough standby pumping equipment to hike the capacity to 375,000 bbl. daily if needed.

. . . To install standby pumping equipment along the Big Inch that would allow the line to be converted from gas to products in an emergency. The line would have a capacity of 425,000 bbl. daily.

Company asked the FPC late in December 1955 for permission to build a 422-mile, 30-in. line from McAllen to Beaumont, Tex. The line would be used to transport imported Mexican gas. The firm also asked the FPC for permission to loop 530 miles of its 30-in. line from Kosciusko, Miss., to Uniontown, Pa. The company will also lay 45 miles of 24-in. from Provident City, Tex., to connect in Matagorda County, Texas. This would tie the Wilcox Trend Gathering System in with the extension from Mexico. The company will add 50,000 hp. in new compressor capacity and enlarge existing stations by 20,780 hp.

Company also has 110 miles of 3, 4, 6, 8, 10, and 12-in. pipe being laid in Texas, Louisiana, Arkansas, Pennsylvania, and Missis

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sippi. Work will be completed in early 1956.

• **Texas Gas Transmission Corp.**—Company has received authority from a FPC examiner to build a 105-mile supply line extending from East Lake Palourde Gas field in Assumption Parish, Louisiana, to its system in Arkansas, Mississippi, Tennessee, Kentucky, and Indiana. The lines and additional compressor facilities totaling 19,190 hp. will cost about $20,000,000.

• **Transcontinental Gas Pipe Line Corp.**—Company received FPC permission on November 29 to construct 24 miles of line to gather gas from South Bayou Mallet, Maxie, and Happytown fields of Louisiana. The project will cost approximately $754,000.

• **Trunkline Gas Co.**—Firm has applied to FPC for authority to build eight new compressor stations and 24 miles of pipeline on its transmission system to enable it to sell additional gas to Panhandle Eastern Pipe Line Co. Total capacity of the new stations would be 56,000 hp. Total cost would be $18,700,000, including $1,000,000 for gathering facilities in the Gulf Coast area. Panhandle filed for 1,600 hp. additional compressor capacity to cost $3,714,000.

• **Utah Natural Gas Co.**—Planning 40 miles from Orem to Salt Lake City, 16-in. pipe at later date. Contract not yet let.

Foreign Crude-Oil Pipelines

• **Cremona Pipe Line Co.**—Firm has announced plans for a 60-mile crude-oil line from the Westward Ho-Sundre area to Calgary.

• **Esso, A. G.**—West Germany affilate of Standard Oil Co. (N. J.) plans line from North Sea port to Rhur-Rhine area. This will probably be 120-mile, 10-in. from Rotterdam to Cologne, the latter rumored as the site of a new 58,000-bbl. refinery to be built by the company.

• **Gulf Italia Co.**—Firm will build a 35-mile line from its Ragusa field in southwestern Sicily to a refinery at Augusta operated by RASIOM, an Italian company. The line size was not disclosed. Work is expected to be completed by the end of summer.

Interprovincial Pipe Line Co.—Majestic Contractors, Ltd., has contract for 67 miles of 24-in. and 2 miles of 26-in. along the company's system from Alberta to Sarnia, Ont. The Majestic work will be between Carroll and Somerset, Man., and 2 miles between the U. S. border and the Gretna pumping station. Work will be completed near the end of summer 1956.

• **Pembina Pipe Lines, Ltd.**—Company has announced proposal to build crude-oil line from Sundre-Westward Ho area of Alberta into Edmonton. Two other companies, Cremona Pipe Line Co. and Rangeland Pipeline Co. also have plans for moving the area's crude.

• **Rangeland Pipe Line Co.**—Subsidiary of Hudson's Bay Oil & Gas Co. has made proposal to build line out of Sundre-Westward Ho area to connect with a line of Texaco Exploration Co. and then go to connections with Trans Mountain and Interprovincial.

• **Standard - Vacuum Oil Co.** — Company has long-range plans for a 90-mile pipeline to give the new Lirik field in Central Sumatra an outlet. Completion is not scheduled before 1957 or 1958.

Westspur Pipe Line Co.—Firm has received government permission to build a 109-mile crude line from Midale, Sask., to the Interprovincial Pipeline Co.'s system at Cromer, Man. The project will cost $6,400,000.

Foreign Products Pipelines

• **Chaco Pipeline & Refinery Corp.**—Firm plans to build 450-mile line from Glen McCarthy's wells in Bolivia to a new refinery to be built at Concepcion, Paraguay.

• **Iraq Petroleum Co., Ltd.**—Company is making plans to lay a 75-mile, 24-in. products line from Homs, Syria, to Tripoli, Lebanon. The line would have a capacity of 180,000 bbl. daily.

• **National Fuel Oil Co.**—This company in Israel is a shareholder in a company which plans to build a products line between Haifa and Tel Aviv. The plans call for a 55-mile 6-in. line in which the Government would own 10 per cent.

• **National Iranian Oil Co.** — Company plans $32,300,000, 573-mile, 10-in. products pipeline from Ahwaz to Teheran, Iran. The line will have a capacity of 40,000 bbl. daily. Costain-John Brown, Ltd., London, will build the 337-mile southern part. Entrepose, Paris, will build the northern 236 miles.

• **North Atlantic Treaty Organization (NATO).**—This defense organization is building products lines to airforce bases in various parts of France. Approximately 2,000 miles of 4-in. line will be laid.

NATO—Associated Pipeline Contractors, Inc., Houston, is laying 450 miles of products line from Iskenderun, Turkey, to Batman, also in Turkey.

Overland Pipeline Corp.—This South African firm has requested government permission to build a 350-mile line, to cost $8,450,000 from the South African coast to Rand, a plateau area in southern Transvaal where there is heavy petroleum consumption.

• **Sinclair Oil Corp.**—Company is considering a 240-mile crude-oil line from its San Silvestre field in the state of Barinas, Venezuela, to Puerto Cabello on the Caribbean Sea coast. The line would cost $25,000,000.

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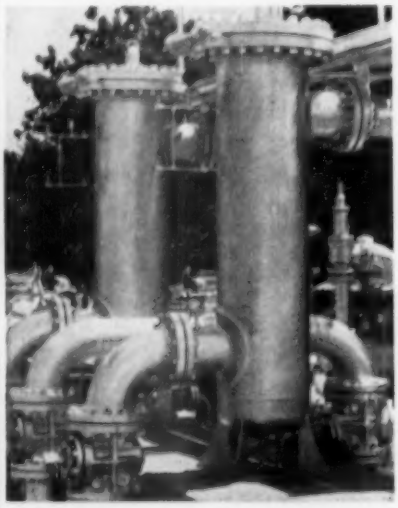

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Department is sponsoring a 485-mile, 8, 10, 12-in. products line from Cadiz to Zaragoza, Spain. The contract has been let to Merritt Chapman & Scott; Benson & Montin of Oklahoma City; and Agroman Construction Co., a Spanish firm. Brown-Raymond-Walsh is the prime contractor. Cost of the line will be approximately $5,000,000.

Winnipeg & Central Gas Co.—Canadian company plans to build a $20 million butane-propane system. Company plans to get gas L.P.G. from Signal Oil & Gas Co.'s Tioga, N. D., plant and move it to Winnipeg. Size and route of the line has not been definitely established.

Foreign Natural-Gas Pipelines

• **Alberta Gas Trunk Line Co.**—Company will spend $47,000,000 to build 547 miles of gas-gathering system for the Trans-Canada line. The 1956 stage of construction will total 219 miles and cost $22,650,000. The first part would start near Saskatchewan and include Pincher Junction, Provost, Bindloss, Sibbald, Oyen, Sunnynook, Steveville, and Cessford. The second part to be built in 1957 will consist of 328 miles and cost $24,400,000. The second phase will include Countess, Duchess, Princess, Homglen-Rimbey, and Nevis.

Attock Oil Co.—Company plans to build 60-mile natural gas pipeline from Dhulian field to Rawalpindi in West Pakaistan.

Cia. Shell de Venezuela.—Company has announced plans for a $21,000,000, 177-mile, 20-in. natural-gas line from La Paz field in the Maracaibo district to the Cardon refinery on Paraguana Peninsula. The gas will be used as the chief fuel in the refiner's furnaces. The line is expected to go into operation in 1957.

• **Empresa Nacional del Petroleo.**—80 miles, 10-in., planned, Concon to Santiago, Chile.

• **Gas Industrial de Monterrey.**—Company has announced plans for a 22-in., 130-mile natural-gas line from Reynosa to Monterrey in northern Mexico. The project will parallel a 14-in. line which has been supplying Monterrey since 1947.

• **North Canadian Oils, Ltd.**—Company will lay 316 miles of 10-in. line from Wabumun to Hinton, Alta. The gas will be sold to a pulp mill at Hinton. Mid-Western Industrial Gas, Ltd., which will supply the gas along with North Canadian, will build a line from its gas fields in the Alexander, Majeau Lake, and Westlock districts to Wabumun.

South Alberta Pipe Line, Ltd.—Company has filed permit to construct a 150-mile, 8-in. natural-gas line from Etzikom field to serve a nitrochemical plant to be built near Medicine Hat, Alta. The line will cost about $1,000,000.

• **Sui Gas Transmission Co.**—Pakistan Constructors, a joint company of Morrison-Knudsen, Boise, Idaho, and William Press Ltd., London, have contract to build a 188-mile, 16-in. line from Sui gas field to Moultan, Pakistan. Work will begin in mid-1956. The line will later be extended to Lahore, with branches at Kot Addu, Jhang, Magiana and Montgomery.

• **Trans-Canada Pipe Lines, Ltd.**—Firm has about completed financing arrangements for a 2,250-mile natural-gas line from Alberta to Toronto and Montreal. The Ontario government has agreed to help finance the line through its province. Tennessee Gas Transmission Co. has proposed a line to take gas from the company at Emerson, Man. (See Midwestern Gas Transportation Co.)

Union of Soviet Socialist Republic.—Russian Government has completed about 200 miles of a 900-mile natural-gas line from Stavropol in the Northern Caucasus to Moscow. The completed section links Stavropol with Rostov. The line is being built of 26-in. pipe and is much larger than the other two major gas lines in Russia which are 16 and 18-in. When completed the line will serve Voroshilovgrad, Voronezh, Tula, Yelets, and Serpukhov.

Westcoast Transmission Co., Ltd.—Company is starting work on a 650-mile, 30-in. line from the Peace River area in Canada to Sumas, Wash. Contractors are Mannix, Ltd., Canadian Bechtel, Ltd., R. A. Conyes Construction Co., and Dutton-Williams Brothers Co., Ltd. Cost to be about $120,000,000.

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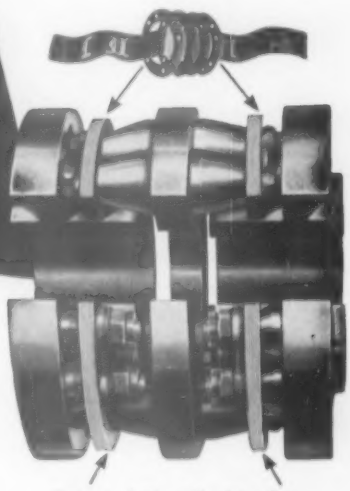

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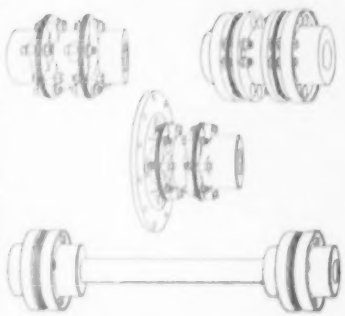

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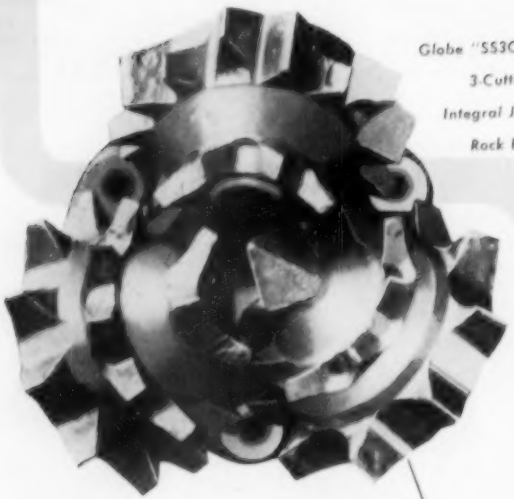

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oil producer in the lower Tuscaloosa

TUBING

Among the

Drilling Contractors

Gene Reid Drilling, Inc., Bakersfield, Calif., is the contractor on a new test Geochemical Surveys and Capital Co. will drill in the Shafter area, Central Kern County, California. Location, 67-7 Shafter Gas Unit 17, in 7-28-25, is 1½ miles north of a gas-discovery well completed by Tide Water Associated Oil Co. 1 year ago. It is a 4,000-5,000-ft. test.

Talbert & Hughey Drilling Co. is scheduled for a 4,900-ft. wildcat test 3½ miles north of Malakoff, in Henderson County, East Texas. It is a contract job for W. C. Windsor, Jr., and Associates with location at 1 Wilmington, in the Thomas Caro Survey.

Holm Drilling Co., Tulsa, is drilling for J. M. Huber Corp. at a wildcat location west of the Greenwood area in southeastern Baca County, southeastern Colorado. It is a 4,700-ft. test. Location, at 1 Morris, in 33-34s-41w, is about 3½ miles west of the Kansas line.

Jett Drilling Co., Inc., Shreveport, has a new, deep wildcat operation under way in eastern Tensas Parish, East Central Louisiana. It is a 9,500-ft. Lower Cretaceous test being drilled as a joint venture of the contractor and J. P. Tischner and associates, of Shreveport and Natchez, Miss. Location, at 1 Panola, in 9-11n-2e, is 1 mile north of St. Joseph, and a little more than 1 mile east of Avondale. It is 3 miles south of Lake Bruin field, nearest production.

Coulston Drilling Co. has a new wildcat operation under contract in Perkins County, Nebraska. It will be for Dietler & Oleson at 1 Malmkar, in 9-9n-40w, 7 miles southwest of Grant.

Crow Drilling & Production Co., Shreveport, has scheduled a 7,200-ft. Pettet test to be drilled as a contract job for David Crow, trustee, and associates in Cypress Springs field, Bienville Parish, North Louisiana. It will be on Crow's Pure-Hodge-Hunt lease, with location in 35-17n-7w.

Wheless Drilling Co., Shreveport, has contracted for a 7,700-ft. Tuscaloosa well to be drilled for Union Producing Co. in the newly opened Wisner field, in Franklin County, northeastern Louisiana. Its location, at 1 Raney, in 3-11n-7e, is 1,100 ft. northeast of Shell Oil Co.'s discovery well, 1 Anderson, completed early in December as a good

Eugene Fry (lower right), tool pusher for Turner Drilling Corp., Mount Pleasant, Mich., with two of his crews on a combination rotary-cable his company has been operating for Turner Petroleum Corp., affiliated production company, on a wildcat test west of Alma, in Gratiot County, Michigan. Crewmen in front row, left to right, are: Liston Williams, rotary driller; Harry Swartwood, cable-tool driller; Beryl Wilkinson, tool dresser. In back row, same order, they are: Clyde Porter, cable-tool driller; Basil Host, rotary driller; Archie Davis, truck driver and relief driller; and Ray Lippold and John Trudeau, tool dressers. In the area, the rotary is used to about 1,500 ft. to get through a high-pressure gas sand. Cable tools then take the hole to about 3,000 ft.

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Is cheap thread dope really a bargain? Tool joint and drill collar thread wear can cost a lot over a year's time. Fishing jobs come plenty high. Galling or washouts mean hundreds of dollars of extra expense. 'Bestolife Lead Seal stretches thread life, cuts down on fishing jobs, galling and washouts. That's why it's the most widely used lead base thread compound in the world. Get 'Bestolife at your supply store. In 1¼, 5, 20 and 50 lb. cans. Unconditionally guaranteed.

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oil producer in the lower Tuscaloosa-Massive sand, perforated at 7,492-98 ft. It is the first confirmation test.

Walker & Wilson Drilling Co., Denver, is on a 4,000-ft. Morrison test it is putting down southwest of Holyoke, in Phillips County, Colorado. It is a joint operation for Hill & Hoppler and its own account. Location, 1-A Hill, a wildcat, is in 24-7n-45w.

B. L. McFarland, Inc., Midland, Tex., has a new 9,500-ft. contract job southwest of the House area, 9 miles south of Hobbs, Lea County, New Mexico. Texas Crude Oil Co. is the operator. The well is its 1-14 Dupress, in 14-20-38.

Woolf & Magee, Tyler, Tex., will drill an 8,700-ft. test 5½ miles northwest of St. Joseph, in Tensas Parish, eastern Louisiana. It is a contract job for Thomas J. Glennon, of Natchez, Miss. Location is for 1-Boyle, in 3-11n-11e. Objective is the top of the Lower Cretaceous.

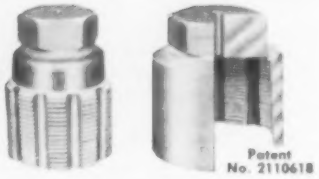
F. E. Hargraves & Sons Drilling Co., Longview, Tex., has taken 2,500-ft. contract in Shreveport field, at Shreveport, in Caddo Parish, northwestern Louisiana. It is a Paluxy test for M. F. McClain and associates, of Shreveport. Location at 1 Chandler, in 34-18n-14w, is in the southwest part of the field.

Larco Drilling Co., Jackson, Miss., is drilling for I. P. La Rue, Jr., at a wildcat location 3½ miles south of Janice, in southwestern Perry County, southeastern Mississippi. Location is at 1-A U.S.A., in 11-1s-11w. Hole will be taken to the top of the Lower Cretaceous, expected about 9,000 ft.

Commonwealth Drilling Co., Ltd., Calgary, Alta., has contracted for another test Home Oil Co., Ltd., will drill to confirm its new oil discovery 6 miles southwest of Harmattan, and 47 miles northwest of Calgary. The new test, 9-7 Harmattan, in LSD 9, 7-32-4w5, is ½ mile north of the Home's Mississippian oil-discovery well (1-7 Harmattan). The wells are joint operations of Home, Calgary & Edmonton Corp., Transborder Oils, Ltd., and Alminex, Ltd.

Tri-City Drilling Co., Calgary, Alta., is moving a rig to a remote wildcat in the Prairie River region in Northwest Alberta Province, location 30 miles southeast of High Prairie, 150 miles northwest of Edmonton, for a Mississippian test it has contracted to drill for Shell Oil Co. in a joint operation with Royalite Oil Co., Ltd. Projected depth is 4,100 ft.

TUBING
Cleanout
TAP *and* **DIES**
by Baird



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Wire Rope at Work— They were at a depth of 2443 ft when this photograph was taken, and the plans called for going another 700. The formation was largely anhydrous. Located near Lefors, Texas, the well was being drilled by Frank Woods Associates, Inc., of Wichita Falls.

A light, portable type of rotary derrick served nicely for the fairly shallow drilling. The rotary line of the rig, Bethlehem 1-in. 6x21 Seale, was already a hardy veteran of oil-field service; it had to its credit six previous wells to depths of 3150 ft. This rotary line, by the way, was still going strong and gave every indication of staying in the thick of things for quite a while to come.

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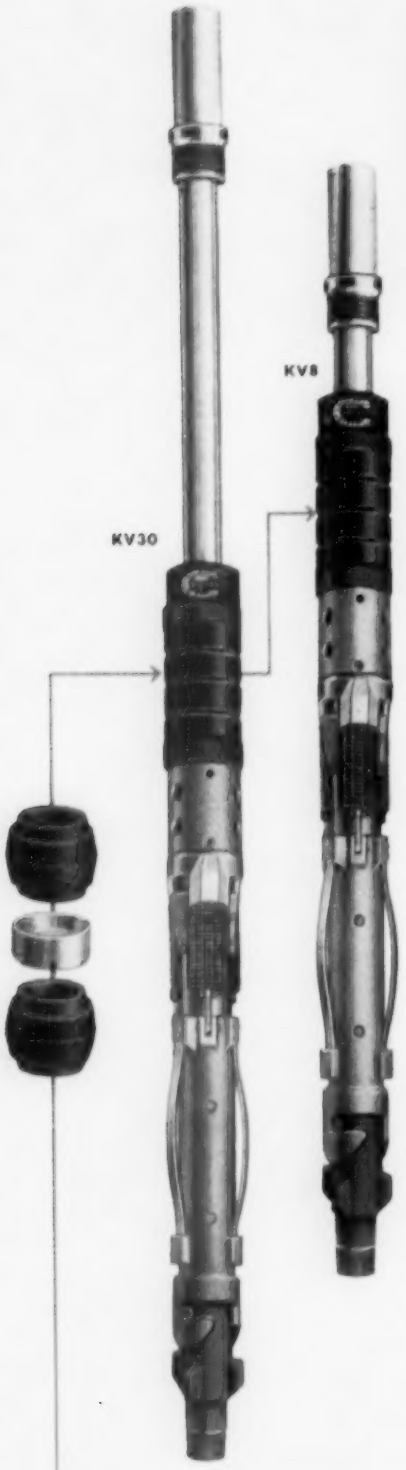

Two-piece G2 rubbers with metal spacer are interchangeable and optional at no extra cost. One-piece sleeve rubber shown on packers furnished unless otherwise specified.

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Here is the retrievable packer that operators everywhere count on for rugged durability and dependable performance. The KV Packer is designed for wells up to 12,000 feet deep. Construction is as simple as it is tough and husky — price is reasonable. In short, the KV Packer gives you more packer for the money — quick setting, easy pulling, ample bypass and positive seal.

- Made as the KV30 with 30″ valve stroke or the KV8 with 8″ valve stroke for standard below-packer circulation. Available in casing sizes, 4½″ through 9⅝″.
- Valve has two independent sealing elements, a tapered metal valve and seat and a set of oil-resistant seal rings, affording double-sealed protection.
- Choice of two types of rubbers, both made of special oil and gas resistant compound. Will not vulcanize to casing — recovers original shape when released.
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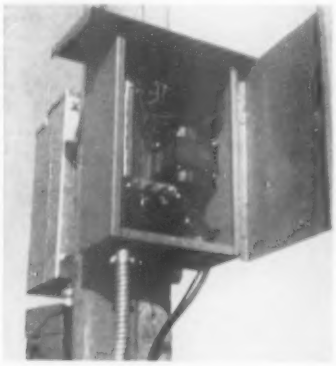
Showcase

OF NEW EQUIPMENT AND LITERATURE

by Dan B. Miller

Small Rectifier Reduces Corrosion Control Cost

An all new, small corrosion rectifier has been designed for low-cost corrosion protection of oil-field installations where low amperage requirements are indicated. Called the Sentinel, Jr., this economy-model rectifier is applicable for corrosion protection of oil-well casing; short oil, gas, or water pipe lines; heat exchangers; bulk tanks; hydraulic lifts; and underground storage tanks; and for any other buried or submerged metal structures where current requirements for ample corrosion protection are small, and where economy is dictated.



Featuring simplicity of design and operation, this new unit is of rugged oil-field-type construction. Transformer and rectifier plates are housed in a sturdy metal case which is easily mounted on the same pole with the power meter and switch. Completely equipped, this new unit is available for immediate delivery in 110/220/440 volts a.c., 12 to 48 volts d.c., and 3 to 6 amp. d.c. sizes. **For more information write or call: Corrosion Rectifying Co., 1506 Zora Street, Houston, Tex.**

●

Mud Sniffer Records Gas Traces in Drilling Mud

The Mud Sniffer is a portable, automatic indicator and recorder of hydrocarbon gases in the drilling mud. As

drilling progresses, it offers a continuous strip-type log of the units of gas plotted against time.

The detecting filaments are supersensitive to minute traces of gas vapors, which are not detectable by smell, weight change, or visual observation of the returns from the hole. The filaments are located remotely from the mud trap which is designed to break the gases out of the mud. Shows of gas in the mud are transmitted from the trap by means of vacuum with a controlled mixture of air to a water trap and filter and thence to the filaments. Three complete detecting systems are provided in each unit to assure uninterrupted performance. Each circuit is balanced and zeroed with the other so that the sensitivity and accuracy can be checked at any time, simply by switching a control valve to any one of the other circuits.

For stability of operation the entire unit is powered by a 12-volt, 200-amp. H.P. battery. It receives its charge from an a.c. or d.c. charger, whichever is required at the rig.

The Mud Sniffer and its component parts are housed in stainless steel cases ruggedly constructed to withstand vibration and shock on the rig and in transit. **For more information write or call: Well Logging Equipment Manufacturing Co., 1920 Hussion Street, Houston, Tex.**

●

New Process Produces Super-Refined BTX

A process for producing super-refined benzene, toluene, and xylene from light oil is being made available

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for the first time in the United States. Use of this process reduces the thiophene content (a harmful sulfur compound) to less than 1 p.p.m. and by subsequent removal of the paraffins a solidification point of 5.40° C. may be readily attained.

During the process, certain impurities of the light oil fraction are removed by hydrogenation. The vaporized light oil and coke-oven gas are passed over a catalyst where impurities are converted into easily-removed compounds. Further purification for the removal of paraffinic compounds is accomplished by distillation techniques. Installation of the equipment for use of this process is easily accomplished and eliminates the need for acid washing of the light oil fractions. **For more information write or call: Koppers Co., Inc., Pittsburgh 19, Pa.**

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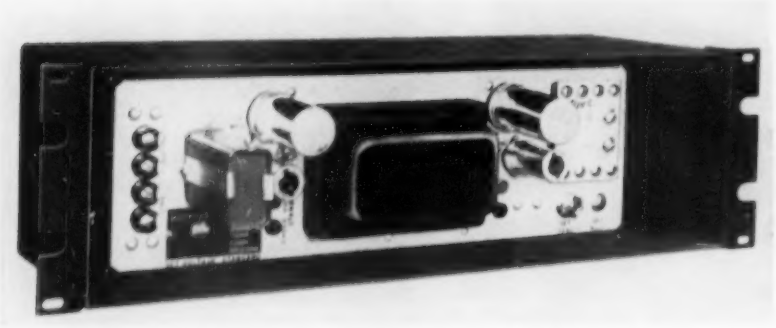

New Potentiometer Draws Low Voltage

A new transmitting potentiometer complementing the division's American-Microsen electronic-process-control system, permits measurement and control of low voltages while drawing negligible current from the source. It is available as a thermocouple pyrometer or to measure direct-current output of electrical transducers.

The transmitting potentiometer uses no slidewires, batteries, standard cell, or converter. It has the simplest possible circuitry, having only two vacuum tubes. The input voltage is automatically balanced against the output signal by the use of the Microsen balance, which also maintains a constant-reference-voltage supply, accurate to 0.05 per cent without periodic standardization.

The transmitter is available in ranges from 6 to 50 mv. (200° F. and up), with zero suppression up to five times the span. The high sensitivity of the unit, better than 3 microvolts, permits extremely accurate control of temperatures when used with the electronic-process-control system.

An output of 0.5 to 5.0 ma. direct current is produced, which can be transmitted over distances up to 30 miles. Repeatability is better than 10 microvolts, and accuracy is better than ¼ per cent under supply voltage changes from 95 to 130 volts. Speed of response for a 10 mv. range is better than ¼ second for 90 per cent response, and speed increases directly with the range. **For more information write or call: Manning, Maxwell & Moore, Inc., Stratford, Conn.**

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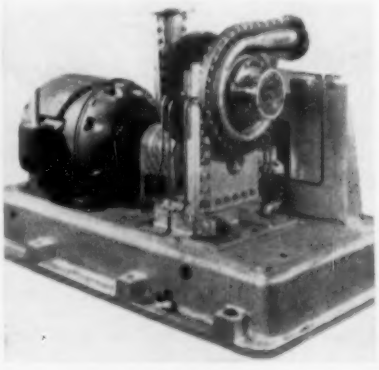


Centrifugal Compressor Furnishes Clean Air

A new low-flow centrifugal compressor furnishes clean oil-free air for use in instrument air systems and for process air. Flows as low as 350 cu. ft. per minute delivered at 65 psia., require 128-hp. Unit as pictured with 150-hp. motor is capable of flows to 750 cu. ft. per minute at 65 psia. Additional models available are: 83A, 86, and 86A rated from 750 to 2,000 cu. ft. per minute at same discharge pressure. These compressors are also available at reduced discharge pressures. **For more information write or call: Sawyer Bailey Corp., 1559 Niagara Street, Buffalo 13, N. Y.**

•

Crake Key Seat Reamer Cuts in Two Stages

Crake key seat reamer is designed to cut key seats out in steps. Around the mandrel section of a turned-down drill collar, three 1-in.-wide bar-steel strips are forged around and welded in place to form three bar-steel spirals. Each spiral is wrapped to make one complete revolution, or lead, approximately every 16 in., and the distance between each spiral is between 2½ to 4 in.

The o.d. of the spiral bars is then turned down to make two equal sections with steps of approximately ½-in. difference between the o.d.'s. The outer surface of each bar is then built up equally with a special alloy tungsten carbide hard metal, care being taken to assure that the leading rotating shoulder of each spiral stays sharp with a 90° angle.

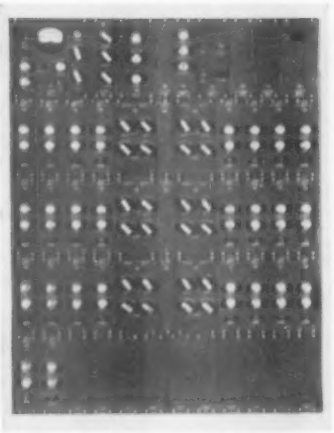
The o.d. of the top section is approximately ½ in. greater than the o.d. of the top connection, and the o.d. of the bottom section is stepped up approximately 1 in. greater than the o.d. of the top section. The o.d. of the bottom section varies from ½ to ¼ in. greater than the drill collars it is used with, depending on the scale.

Always mounted directly on top of the drill collars with the drill pipe screwing into the top of the reamer, the reamer will contact the key seats ahead of the drill collars on coming out of the hole. The key seats are cut out in steps to an o.d. larger than the following, smaller o.d. collars. **For more information write or call: Cochran & Dean Co., Box 6803, Houston 5, Tex.**

•

New Seismograph Designed As All-Purpose Equipment

A new seismograph system designed for all types of seismic recording, whether high, conventional, or low fre-



quency, reflection or refraction, offers linear recording over the wide frequency range of from 3 to 500 c.p.s. and is the most versatile seismic system yet developed.

The new system, called the 7000B, incorporates the features of three field-proven systems, will function with magnetic recording, and yet weighs no more than a standard seismograph system. By a simple switching operation, the operator can record in any one of the three frequency ranges: wide band, magnetic, and very low frequency (3 to 500 c.p.s.).

Its wide frequency response makes it ideal for data storage through magnetic recording. Playback at selected settings allows detailed examination of the complete seismic spectrum. Very low frequency linear recording down to 3 c.p.s. and high sensitivity ideally suit the 7000B to determining sedimentary thickness in large basins. All refraction technique requirements can be satisfied with the 7000B while using relatively small charges. **For more information write or call: Houston Technical Laboratories, 2424 Branard, Houston 6, Tex.**

●

Escape Slide Incorporates Reliable Means of Braking

A new escape line for oil derricks has been developed for use with the sky hook safety elevator to permit fast, completely safe escape. Developed especially for drilling barges and platforms, the Dyco automatic escape slide can be used on all derricks, providing an easy, reliable means of escape.

A man can easily brake his descent at any time, even on a steep slope. Another feature is the use of the safety elevator's counterweight to provide an additional automatic braking effect. There is no danger of falling. A man attaches himself to the escape slide while standing on platform or while still holding to derrick. There is no hazardous climbing out over open space to get on, no chance of falling off. The man's weight overcomes counterbalance and automatically pulls escape slide from retention clamp holders. There is nothing to untie, just hook work belt's D-ring in large safety hook and step off to safety. **For more information write or call: Dykes, Inc., 1121 Rothwell Street, Houston, Tex.**

●

Toggle Valve Is Quick Acting for Tight Shutoff

A toggle operated shutoff valve is quick acting when immediate dead tight shutoff is required. Designed for liquid or gas for any pressure up to 3,000 psi., this new valve will provide positive, leakproof shutoff.

Perfect sealing is achieved by use of a resilient O-ring, protected from the fluid stream by a floating sleeve arrangement. The O-ring is not required to pass a port or other diametral relief or construction which might inflict damage to its surface.

These valves can be used in either hydraulic or pneumatic service and operate smoothly and easily up to their full rated capacity. Even though the valve opens and closes quickly, the stem crosses a throttling seat which insures gradual starting or stopping of the flow, eliminating shock or water hammer in the system. Detent locks valve in open or closed position. The valve is held closed by the positive

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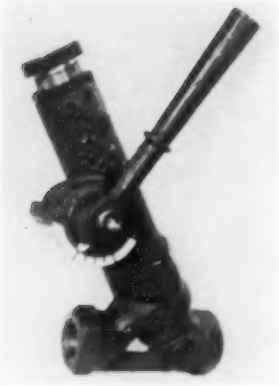
lock of the lever cam arrangement rather than by spring pressure. No adjustment is necessary to compensate for wear or to keep valve tight. In the closed position, the greater the pressure, the tighter the valve seals. **For more information write or call: James-Pond-Clark, 2181 East Foothill Boulevard, Pasadena 8, Calif.**

Quick-Opening Valve Made For Steam, Air, or Gas

A new steel, quick-opening valve for service at 600 psi. at 800° F. and 1,200 psi. at 100° F. is recommended for use on steam, hot water, air and gases.

Streamline design of valve permits maximum flow, and construction assures fast, positive openings and closures at pressures to 1,200 W.O.G. **For more information write or call: Klinger Corp. of America, 95 River Street, Hoboken, N. J.**



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Actrac Guides Pilot and Records Line of Flight

The Actrac (ACcurate TRACking) flight-display unit is used in conjunction with Lorac precision electronic positioning system. It may also be used for maritime positioning as well as air navigation. Lorac provides the accurate positioning requirements necessary for offshore-oil prospecting.

Actrac is a dual role device. It is used to guide the pilot, as well as to record the actual line of flight. Prior to flight, the course the pilot is to fly is accurately drawn on a chart which is fed into the Actrac unit. During flight, the plane's travel also is traced on the chart. The second line superimposed on the first indicates the pilot is on course. If the aircraft is thrown off course 50 ft. to the left or right, the navigator presses the corresponding button, which activates the proper signal light. On course, the central light so indicates. Signal lights for integrals of 50 ft. out to 200 ft. are used. For reference checking, a movie camera photographs the corresponding Lorac meter readings every 20 seconds.

Actrac must be used in areas served by SSC's Lorac systems. This development uses the phase comparison of radio signals to position equipment engaged in offshore drilling. Generated by land-based transmitters, the Lorac signals are received on equipment in the Gulf of Mexico where it pinpoints position. Actrac assimilates this position data continuously converting it into a record of the path taken by the equipment. **For more information write or call: Seismograph Service Corp., Kennedy Building, Tulsa, Okla.**

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Thermxchangers. Users of shell-and-tube type heat exchangers will find a new 32-page technical catalog a valuable guide to efficient equipment selection. Engineers devoted over a year of study to the development of simplified performance curves which cover converters, instantaneous heaters, and process equipment. This new catalog uses a carefully prepared system of easily understood curves and examples because equipment selected from curves which cover the full performance range can cope with future, or seasonal, needs of the system in which the installation is to be made. Also covered in the catalog are reliable comparisons of the various types of shell-and-tube heat exchanger equipment, which design and maintenance engineers will find extremely valuable. **For more information write or call: E. C. Cooley Co., 1186 Folsom Street, San Francisco, Calif.**

●

Nalco Treatment for Cooling Tower Systems: Synergized Polyphosphates Plus Low pH. Bulletin C1 explains how Nalco's synergized polyphosphates and lower pH conditions prevent scale, corrosion, and wood rot as well as cutting maintenance costs and downtime. The system is effective in protecting cooling towers using hard-to-treat water which has organic contamination, high sulfate or chloride concentration, or suspended or soluble iron. **For more information write or call: National Aluminate Corp., 6216 West 66th Place, Chicago 38, Ill.**

●

A Handbook of Drilling-Control Instruments. This new pocket-size, 18-page booklet, Bulletin P-61, has photographs, schematics, and short descriptions, gives a resume of the different kinds of drilling control and auxiliary instruments used on today's modern rigs and parts they play in the over-all drilling operation. **For more information write or call: Martin-Decker Corp., 3431 Cherry Avenue, Long Beach 7, Calif.**

●

Flexible Compression Fittings. This 12-page brochure, well illustrated by photographs and drawings, highlights the use of these fittings on steel piping and copper tubing. Illustrations of typical uses of Style 65, 88, and 90 fittings, taken from case histories and featured throughout the catalog, will be of special interest to equipment designers and piping engineers. Complete specifications of these no-thread and copper-tube fittings are also given in this catalog. **For more information write or call: Dresser Manufacturing Division, one of the Dresser Industries, Bradford, Pa.**

●

Finned Heat Exchangers. A new bulletin describes a finned design of heat exchanger which has been specially developed for recovering waste heat from high-temperature gases such as petroleum-refinery vapors, and gas turbine regenerators, to preheat air or other gases and vapors. The bulletin describes and illustrates the design and construction of this exchanger, which has extended surfaces on both the shell and tube sides and operates on the cross-flow principle for maximum transfer of heat between gases. **For more information write or call: Griscom-Russell Co., Massillon, Ohio.**

●

Flexible Metal Hose. A 12-page, two-color, illustrated Catalog 152 covers the complete line of Flexon flexible metal hose. The full range of flexible-metal-hose products are covered along with complete coupling data. An easy four-step metal-hose selection guide is included. **For more information write or call: Flexonics Corp., 1346 South Third Avenue, Maywood, Ill.**

●

Process Pump Bulletin, a new 20-page, two-color process-pumps bulletin, now available, fully describes vertically split, single-stage and two-stage-type process pumps. In this bulletin, Form 7094-B, are design features of the pumps, dimension tables, cross-sectional and installation views, plus a two-page chart showing the extensive interchangeability of parts through the entire line of pumps. These units are built in accordance with latest A.P.I. specifications. The range of coverage is from 1 to 8 in. including capacities to 3,200 g.p.m., heads to 925 ft., at temperatures to 800° F. **For more information write or call: Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.**

●

Hydraulic Pumping Jacks. Bulletin No. HPJ-020.2 illustrates in color, a complete line of hydraulic pumping jacks together with specifications and performance data. **For more information write or call: Pelton Water Wheel Co., 2447 East Fifty-fourth Street, Los Angeles 58, Calif.**

●

Nelson low-voltage metal-enclosed drawout switchgear using air circuit breakers is the subject of a new 16-page brochure, Bulletin 722. Of interest in this new brochure are the many photographs picturing the component parts of the low-voltage switchgear and the part that each plays in the finished article. In addition there are cross-section drawings of both indoor and outdoor units. Another page is devoted to different standard arrangements of circuit breakers and instrumentation and a foundation plan for outdoor units. **For more information write or call: Nelson Electric Manufacturing Co., 217 North Detroit, Tulsa, Okla.**

●

McEvoy Catalog No. 56 furnishes complete information on dual-completion equipment, including dual trees, dual bore valves, combination valve and tee, and parallel-string well-completion accessories. Also included are data on 15,000 lb. W.O.G. valves and christmas trees. Cutaway drawings, performance curves, photographs, technical data, and schematic illustrations are included in the catalog. **For more information write or call: McEvoy Co., P. O. Box 3127, Houston 1, Tex.**

●

Type HMC Centrifugal Process Pump. Five major advantages of Type HMC centrifugal process pumps with integral seal are outlined in a revised Bulletin W-341-B17A. Information is presented on single-stage vertically split process pumps with capacities up to 1,200 g.p.m. and heads to 475 ft. Outline drawings show typical section of HMC refinery pump, Type PTO balanced Duraseal, and Type 2-B balanced John Crane seal. Charts list information on bearing assembly, flange data, materials of standardized construction, and interchangeability. **For more information write or call: Worthington Corp., Harrison, N. J.**

●

Tubing and Surface Safety Valves. A new, eight-page bulletin on a line of tubing and surface safety valves describes the purposes, operating principles, and design details of the valves, and illustrates typical installations. Included is information on the Type X surface safety valve, a full opening gate valve available with high and/or low-pressure pilots activated by increased or decreased pressure variations beyond predetermined limits; the Type C valve for flow wings, which operates simi-

larly to the Type X; and five types of tubing safety valves. **For more information write or call: Otis Pressure Control, Inc., P. O. Box 7206, Dallas, Tex.**

●

Oil Field Equipment, 1956-57 Catalog. Complete specifications and prices are tabulated and equipment ranging from pump accessories to tool joints is illustrated in this new 57-page catalog. Some of the major lines covered are fittings, catheads, overshot, packer holddowns, tool houses, packers, paraffin scraper, drill collars, subs, kellys, and drill pipe. **For more information write or call: American Iron & Machine Works Co., Inc., Oklahoma City, Okla.**

●

Gyrol Fluid Drive. A new eight-page, two-color, profusely-illustrated catalog, Bulletin 9619, describes the new Type VS Class 2F Gyrol fluid drive for diesel-engine applications. The catalog describes construction and operational features of the Class 2F adjustable-speed fluid drive as applied to diesel-engine installations. Operating characteristics are described in detail for such oil-field machinery as draw works and rotary and slush pumps. The use of the new units in compounding multiple engine drives is also discussed. Typical installation photos are also included. A two-color section drawing is accompanied by a detailed explanation of how the Gyrol fluid drive works. Outstanding features are listed and thoroughly discussed. Also included are specifications and installation drawings. **For more information write or call: American Blower Corp., Detroit 32, Mich.**

●

Kel-Ray Projectors. A new Bulletin P-196 describes the new Kel-Ray projectors for industrial radiography with gamma rays. Projectors are available in three sizes and offer a choice of radioactive isotopes of different intensity. The four-page, two-color bulletin explains how the portability, safety, versatility, and economy of the new gamma-ray equipment expands the range of applications in which radiography may be used as a practical, economical tool for nondestructive testing. **For more information write or call: Metal & Thermit Corp., 100 East Forty-second Street, New York 17, N. Y.**

●

Union Process Heating Equipment. Bulletin DV presents the full line of Union process-heating equipment for use with Dowtherm A and E, Para-Cymene, Arclor 1248 and heat transfer oil. Described and illustrated are various vaporizers (both packaged and field-erected units), electrically heated vaporizers, and forced-circulation liquid heating and cooling units which can be used to provide a wide range of accurately controlled temperatures at low pressure. **For more information write or call: Union Iron Works, Erie, Pa.**

●

L.P.G. Carburetion Equipment. A completely new colored, fully illustrated catalog covers the complete line of liquefied-petroleum-gas carburetion equipment. This Manual 108 covers the entire subject from behavior characteristics of the fuel to its utilization as an internal-combustion engine fuel. Diagrams, tables, and sectional views are included. **For more information write or call: Ensign Carburetor Co., 7010 South Alameda Street, Huntington Park, Calif.**

●

Wireco Slings and Fittings. A new 80-page catalog features slings and fittings. It illustrates and describes 54 sling types with accompanying capacity tables for each. The most commonly used fittings are also illustrated with capacity tables. **For more information write or call: Wire Rope Corp. of America, St. Joseph, Mo.**

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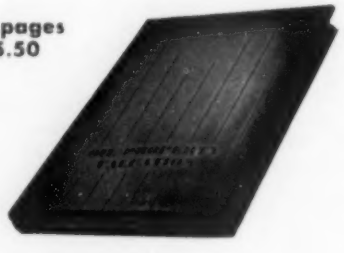

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EQUIPMENT MEN . . . in the News

Schlumberger Announces Four Management Changes

Four important Schlumberger Well Surveying Corp. management personnel changes were announced recently by Pierre Schlumberger, president.

F. G. TAVES

M. E. LOY

Fritz G. Taves, former Pacific Coast area manager and recently on the staff of the Schlumberger president, has returned to his former post with headquarters in Los Angeles. Milton E. Loy, former Pacific Coast area manager, has been named Mid-Continent area manager in Tulsa. Charles K. Ruddick, former Mid-Continent manager, has moved to New Orleans as manager of the Southeast area. Charles A. Doh, former Southeast manager at New Orleans, has been transferred to Houston to the newly created position of manager of customer relations.

C. K. RUDDICK

C. A. DOH

From 1927 to 1929 Taves was with Richfield Oil Corp. He served in the California State Oil Umpire's office from 1929 to 1935, in which year he joined Schlumberger. Loy, who joined the firm in 1940, has served as location manager in Sacramento and Bakersfield, Calif. In 1938 he was made assistant Pacific Coast manager and became manager in 1954.

Ruddick has served Schlumberger in various locations in Oklahoma, Texas, and Kansas. He was made assistant division manager in Illinois in 1945, became assistant area manager of the Mid-Continent area in 1951, and was promoted to area manager in 1952. Doh joined Schlumberger in 1934 and worked in Roumania, Venezuela, Texas, and Illinois. He served as Illinois division manager from 1945 to 1951. In 1951 he went to New Orleans as manager of the Southeast area.

Republic of California to Represent Roebling's Sons

John A. Roebling's Sons Corp., wire-rope manufacturers, Trenton, N. J., and Republic Supply Co. of California have concluded an agreement under which the latter is now distributor for Roebling products in California, Arizona, and Nevada. The announcement was made jointly by John J. Pike, president of Republic Supply, and Walter A. Huber, general product manager, Wire Rope Division, for Roebling. This information is of particular interest to western industry in general and to the petroleum industry of California since Republic's 18 sales headquarters and branch stores will make Roebling products more readily available to the territory involved.

Republic Supply Co. of California, an independent western firm, founded in 1910 by P. M. Pike, present chairman of the board, operates 18 sales points throughout the area.

Clark Bros. Names Smith To Head California Area

Clark Brothers Co., one of the Dresser Industries, has announced the appointment of Robert C. Smith as California district manager. Smith was formerly administrative sales manager at the company's home offices in Olean, N. Y. A. K. Hegeman, Clark vice president and until now California district manager, will continue at the Clark Brothers' Los Angeles office as consultant until his retirement in September 1956.

Rockwell Made Hydraulic Sales Manager By Axelson

J. W. ROCKWELL

J. W. Rockwell has been appointed sales manager; hydraulic-unit division for Axelson Manufacturing Co., division of U. S. Industries, Inc. Rockwell, reporting to K. S. Ramey, sales manager petroleum equipment, will be in charge of all sales of Axelson long-stroke and Hydrax hydraulic pumping units to the petroleum industry.

Rockwell has, for the past 18 years, been with his company in the Mid-Continent oil fields. He will headquarter in the Axelson Los Angeles main offices.

Kiser Is District Manager At Lane-Wells Odessa Office

John W. Kiser has been appointed district manager for the West Texas district, it was announced by R. E. Bush, Gulf Coast division manager, Lane-Wells Co.

Kiser has been with Lane-Wells since 1946. He joined the company in the South Louisiana area, where he served as perforating and radioactivity well-logging operator. Later he served as sales engineer in Mississippi, subdistrict superintendent in Mississippi, and assistant district superintendent in South Louisiana. Prior to his appointment as district manager, Kiser had been for 3 years district superintendent of the Arklatex district.

C. E. Shilcutt, retiring district superintendent, goes to Houston as district manager of the Lane-Wells Houston district.

New Cabot Buildings Add 43,000 Sq. Ft.

Aerial view of completed Cabot Shops, Inc. plant at Pampa, Tex., with the recent addition of a new building providing 43,000 sq. ft. of new floor space. The new plant building, as well as other parts of the plant, are fitted with the latest equipment, including a hydraulic herringbone gear cutting machine, one of the few made as yet by Farrell-Birmingham Co., according to R. A. Baker, vice president and general manager. Baker is also president of the Franks Division of Cabot Shops, Inc. at Tulsa.

ElectroData Dedicates New Pasadena Plant

ElectroData Corp. recently dedicated this new, half-million-dollar plant in Pasadena, Calif., in a ceremony highlighted by a talk from Dr. Lee DuBridge, president of California Institute of Technology.

The structure is the first of two such facilities completed to manufacture high-speed electronic computers. ElectroData is an affiliate of Consolidated ElectroDynamics Corp.

Prior to DuBridge's talk, ElectroData Pres. James R. Bradburn described the new plant as being "representative of progress toward man's goal of dominion over the routine, the repetitive and the uncreative." Hugh Colvin, general manager of the parent affiliate, Consolidated ElectroDynamics Corp., traced the development of the company from its earliest origins with Herbert Hoover, Jr.'s United Geophysical to the time when ElectroData was established as an independent Consolidated affiliate in 1954.

Houston Technical Lab's Start New Plant

Construction has begun on the new main plant for Houston Technical Laboratories, Texas Instruments geophysical-instrumentation subsidiary, according to TI Pres. J. E. Jonsson. The 40,000-sq.-ft. building is being built on a five-acre tract on Buffalo Speedway in Houston.

When the modern new building is completed next spring, HTL will be able to consolidate its research, design, and manufacturing operations. The largest portion of the building will be an unobstructed manufacturing area measuring 180 by 120 ft. and offering great flexibility in the arrangement of equipment-manufacturing lines. A geophysical - instrumentation museum will also be located in the lobby area.

Pierson Joins Eggelhof As Vice President

T. H. PIERSON

T. H. Pierson, former assistant maintenance director of Corn Products Refining Co., has joined Eggelhof Engineers, Inc., Houston, as vice president, according to Robert Molnari, vice president. Pierson will head one of the process divisions and also assist in overall management of the engineering company, which maintains seven offices in Texas, Louisiana, and Oklahoma.

Prior to joining the company, Pierson was with Corn Products Refining for 8 years. Before that, he served as foreman of the instrument department of B. F. Goodrich Chemical Co. near Beaumont, Tex. His first position was with Magnolia Petroleum Co.

Peerless Appoints Blair As Process Pump Specialist

The appointment of Walter J. Blair as process pump specialist has been announced by Peerless Pump Division, Food Machinery & Chemical Corp. Blair will devote his time to pump application problems in refineries, chemical-process and industrial plants, coordinating his efforts with Peerless field engineers and distributors.

Blair has been with Peerless Pump Division 8 years in field sales work in the company's Pacific district. His headquarters will be at the company's Los Angeles plant.

National Supply Names Etnyre as Plant Manager

R. H. ETNYRE

Robert H. Etnyre has been appointed plant manager of the Toledo plant of National Supply Co. He succeeds Robert E. Valk who resigned as works manager.

Etnyre started with the company in 1946 as a methods engineer at the Toledo plant, and subsequently was assigned to time study work, tool engineering, and plant accounting. He was appointed staff assistant to the works manager in 1952 and in that position was active in the planning and construction of the company's new plant at Gainesville, Tex.

Orbit Names Brunsman As Field Representative

Joseph F. Brunsman has been appointed field representative for the San Juan Basin with headquarters in Farmington, N. M., according to L. E. Wallace, general sales manager for Orbit Valve Co.

Brunsman was employed by National Supply Co. at Worland and Cody, Wyo., before joining Orbit Valve Co.

Perforating Guns Atlas Holds Annual Sales Meeting

The annual sales conference of Perforating Guns Atlas Corp. was attended by over 60 staff members. PGAC's district manager, technical representatives and salesmen serving the Southwest oil fields, met with the company's home office management and engineering executives for two days at Houston. Paul Charrin, president of PGAC, told the group that the oil-field service company's business for 1955 to date had broken all previous records. J. H. Castel, executive vice president, indoctrinated the group with the company's recent scientific developments in well-perforating and logging techniques.

Garrett Oil Tools Names Service Representation

In order to provide users of Garrett pressure-relief valves with local sales and service representation, Garrett Oil Tools, Inc., of Longview, Tex., has established a nation-wide organization of independent sales agencies that will represent the company among the transmission and distribution industries. Authorized agents are as follows: Bass Sales & Equipment Co., Shreveport, La.; Malcolm W. Black & Co., Inc., New York, N. Y.; L. A. Christopher Co., Denver; A. E. Ehrke & Co., Cleveland, Ohio; Joseph W. Eshelman & Co., Birmingham, Ala.; General Meters & Controls Co., Chicago 6, Ill.; Owen C. Jones & Co., Wellesley Hills, Mass.; P. C. McKenzie Co., Pittsburgh, Pa.; Rittelmeyer & Co., Inc., Atlanta, Ga.; R. S. Stover Co., Marshalltown, Iowa; Tri-State Industrial Supply Co., El Paso, Tex.; H. D. Hale & Co., St. Louis, Mo.

In addition to the services provided by their agents, Garrett Oil Tools, Inc., which now operates as a division of U. S. Industries, Inc., of New York City, will continue to supplement their agents' services with factory representation and service.

Oilwell's California Area Announces Sales Realignment

A realignment of sales and service responsibilities in the California area of United States Steel's Oil Well Supply Division has been announced by D. S. Grubbs, area manager.

John W. Brown has been appointed area merchandise manager. From his Los Angeles headquarters, he will have supervision of managers of Oilwell branch stores in seven California cities.

Formerly under supervision of the branch store manager in their area, Oilwell's field selling force has been divided into five groups to provide greater specialization. The groups and their managers are: tubular goods, W. F. Parker; drilling equipment, E. W. Clark; production equipment, J. P. O'Neill; and refinery and pipeline equipment, Michael Jacoby. The fifth group, composed of general salesmen not assigned to any specific product, will be headed by N. G. Kirkland, assistant to the California area manager. In addition to his above duties, Clark will be in charge of foreign drilling-equipment sales representation on the West Coast.

Al Moore, James Doan, and James Renfro will supervise drilling-equipment sales from headquarters at Long Beach, Bakersfield, and Ventura. Oliver Trechter and Carl Schwab will be in charge of pumping-equipment sales at Long Beach and Bakersfield areas. Edward Leicester has been assigned to refinery and pipeline-equipment sales, Los Angeles. Thomas L. Campbell has been named assistant manager, tubular sales, Los Angeles. Robert Watkins, California area engineer, will supervise machinery service men stationed at Bakersfield, Ventura, and Los Angeles.

Obed P. Fitzgerald has been made manager of the store at Castaic Junction. Arne S. Johnson and Amos L. Cook, Jr., are district representatives at Bakersfield, Calif.; Julius H. Cooke, Jr. has been named district representative, Long Beach, and Harold W. Scott is district representative at Avenal.

Tulsa Chapter, A.S.P.E. Elects, Plans for 1956

The state convention of the Oklahoma Society of Professional Engineers looms as a major activity for the Tulsa chapter during 1956. Talking over this event, February 23-25, are the chapter's newly elected officers. Front row, they are: M. T. Nigh, Service Pipe Line Co., executive vice president; W. R. Clarke, Jones & Laughlin Steel Corp., Supply Division, president; and L. T. Bossard, Bos-Co Equipment, Engineering & Manufacturing Co., outgoing president. Back row are: M. J. Myers, Jr., Public Service Co., secretary-treasurer; F. M. Bartlett, Bartlett Engineering Co., vice president, meetings and programs; C. M. Gordon, Jr., General Electric Co., vice president, public relations; and M. J. Peterson, Oklahoma Natural Gas Co., vice president, memberships.

De Laval Makes Horth Ass't. Manager, Compressor Sales

J. D. HORTH

John D. Horth has been appointed assistant manager of the compressor sales department at De Laval Steam Turbine Co., Trenton, N. J., according to an announcement by James P. Stewart, president. Horth joined De Laval in 1947. He served in the Chicago sales and service headquarters until 1949, when he was named district manager of the St. Louis office. In 1951 he was transferred to the compressor sales department in Trenton.

Banks Joins Davison for Catalyst Sales, Service

In a further expansion of the petroleum catalyst department of Davison Chemical Co., division of W. R. Grace & Co., W. L. Banks has been named sales representative to service customers in the area covered by the company's Houston office.

Banks has been with the Central Intelligence Agency. He was previously with The Texas Co. at Port Arthur, Tex.

McCullough Tool Announces Organization Changes

L. J. McCullough, president of McCullough Tool Co., has announced two major organizational changes in the company's Pacific and Mountain divisions. Jim Edwards has been promoted to sales manager of the Mountain division and has established new division sales headquarters in the Commonwealth Building, Denver, Colo. Newton Ottinger, division logging engineer, will also work out of the new Denver head-

JIM EDWARDS

GLEN HORRIE

quarters. Glen Horrie has been transferred to Bakersfield as McCullough's San Joaquin Valley district sales manager.

For the past year Edwards has served as geologist and sales engineer for McCullough in Denver. Prior to this he was logging engineer at McCullough headquarters in Los Angeles, doing research on interpretation of radiation well logs. Horrie was a McCullough sales engineer in Bakersfield prior to becoming sales manager at Casper, Wyo.

Petro-Chem Development Names Two Sales Agents

The appointment of two sales agents for its complete line of Iso-Flow heaters has been announced by Petro-Chem Development Co., Inc., of New York City. Faville-LeVally Corp., Chicago, will extend the territory they serve to include the states of Illinois, Wisconsin, Michigan, together with northern Indiana, western Ohio, and the city of St. Louis, Mo.

G. M. Wallace Co., Denver, Colo., will serve the states of Montana, Wyoming, Colorado, and New Mexico (except Lea, Eddy, and Otero counties).

Nelson Electric Supply Elects New Officers

MRS. NELSON

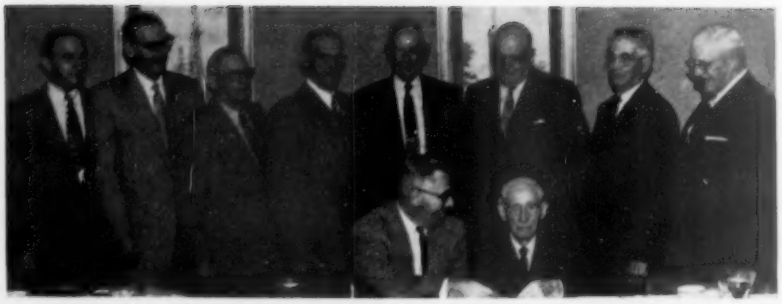
The board of directors of Nelson Electric Supply Co. of Tulsa, in a recent, special meeting elected the following officers to fill vacancies occasioned by the passing of the late Courtney B. Nelson: Mrs. V. H. Nelson, board chairman and secretary-treasurer; W. L. Muir, president; D. F. Nash,

W. L. MUIR

D. F. NASH

executive vice president; C. B. Nelson, Jr., and P. K. Nelson, vice presidents; and Charles L. Boyer, assistant secretary.

Nelson Electric Supply Co. was founded 30 years ago by Courtney B. Nelson. The company started with three employes and now employs 42.



Petroleum Production Pioneers Honor C. E. Wilcox

At a recent meeting of the board of directors of Petroleum Production Pioneers, C. E. (Dad) Wilcox, pioneer designer and inventor of oil tools was presented a life membership in the organization. Witnessing the award were (left to right), sitting: D. B. Pinnell, field manager of Union Pacific Railroad Co.'s oil operations, president of the Petroleum Production Pioneers; and C. E. Wilcox. Standing: Frank Seaver, Hydril Corp.; R. T. Harcus, Byron-Jackson Co.; Tom Selser, Macco Corp. (retired); Lin Little, Standard Oil Co. of California (retired); R. E. Stearns, Universal Consolidated Oil Co.; Bill Todd, Standard Oil Co. of California (retired); C. J. McLaren, Hughes Tool Co.; and Tom Hickey, Hickey Pipe & Supply Co.

Highlighting the Wilcox career was the invention of the Kelly and the square bushing with a tapered bowl that permits wedge slips to be inserted for gripping the pipe. He has been responsible, however, for the development of tongs, elevators, underreamers and other tools that are now in wide use.

Wilcox began his oil career with the original Standard Oil Co. at Maxbury, Ohio, and has since compiled a total of 70 years in the business. After working around the San Joaquin Valley for a time he drilled what he believes was the first producing well in Utah at Ryolite. He entered the employ of Wilson & Willard and, except for brief periods with Baash-Ross and Web Wilson, stayed with Wilson & Willard and its successor, Byron-Jackson, until his retirement.

Pittsburgh Coke Reassigns Sales Representatives

The Protective Coatings Division of Pittsburgh Coke & Chemical Co., Pittsburgh, Pa., has announced two new sales assignments for its pipeline enamels and cold coatings.

J. E. Himmelrich has been reassigned from Pittsburgh to the Tulsa office and will represent the division in the states of Oklahoma, Kansas, Nebraska, and Colorado. M. P. Ellis, who has moved to the Pittsburgh office, will cover the territory consisting of Ohio, Kentucky, West Virginia, and western Pennsylvania.

Watson-Stillman Alters Name To W-S Fittings Division

Watson-Stillman Fittings Division, H. K. Porter Co., Inc., approved a change in its name to W-S Fittings Division, it was announced recently by Jackson Kemper, vice president and general manager of the division.

The division's trade mark, two diamonds separated by the letters W-S, will be retained. The trade mark appears on all existing W-S fittings and will also be used to identify new products. The W-S Fittings Division was acquired by Porter in 1952 and today is a leading manufacturer of forged steel fittings.

Barrett Names Kiernan As Technical Engineer

Frank J. Kiernan has been appointed technical engineer of protective coatings sales for Barrett Division, Allied Chemical & Dye Corp. He was formerly assistant chief engineer of United States Stoneware Co. and, prior to that, project leader and developments engineer for Stauffer Chemical Co.

McCullough Tool Announces Three New Service Points

O. J. McCullough, vice president of McCullough Tool Co., has announced the opening of three new service locations in its eastern division.

These service branches are at Aztec, N. M., Charlotte, Tex., and Salem, Ill. The Aztec branch is under the direction of J. L. Massey. W. D. Stroud is in charge of the Charlotte branch, and Jack N. Lawson is senior operator in charge of the Salem location.

Chicago Bridge & Iron Expands Two Offices

Enlarged sales office in San Francisco and Tulsa have been announced by Chicago Bridge & Iron Co.

The new address of the San Francisco office is 100 Bush Street, San Francisco 4. New location for the Tulsa office is the Dowell Building.

OPW Announces Appointment Of Muller and Madden

E. P. MULLER

Edward P. Muller, formerly vice president and general sales manager of Eaton Metal Products Co. operations in Denver, has been made district manager, and Michael J. Madden has been named sales engineer for OPW Corp., according to Gilbert B. Richards, president.

Muller's territory will be the Rocky Mountain area, comprising the states of Montana, Idaho, Utah, Wyoming, Colorado, and New Mexico. Madden will work on sales research and support OPW jobbers and district representatives in the United States, its territories, and Canada.

Otis Opens New Office In Hattiesburg, Miss.

Otis Pressure Control, Inc., Dallas, has opened a district office in Hattiesburg, Miss., with Perry Spencer as wire-line specialist in charge. Otis officials said the new point was opened due to increased volume in the area and to give operators better service.

I-H Names Kuntz Assistant Manager, Truck Sales

Appointment of Duane F. Kuntz as assistant manager of motor truck sales has been announced by W. C. Schumacher, vice president and general manager of International Harvester Co.'s motor truck division. Kuntz previously was manager of the company's southwest motor truck sales region and has been located in the company's general office in Chicago as a regional manager since 1950.

Kuntz joined International Harvester in 1926 as a sales trainee. After serving in various capacities, he was promoted to manager of the Jackson, Mich., motor truck branch and later went to Grand Rapids, Mich, in the same position. He has served as assistant district manager at Aurora, Ill., Toledo, Ohio, and Minneapolis, Minn., and became manager of the Minneapolis motor truck district in 1947. Kuntz was advanced to manager of the eastern motor truck sales region in 1950 and in 1953 was placed in charge of the Southwest sales region.

Chiksan Names Territory Representative

Malcolm W. Black Co., Inc., New York City, has been appointed representative for Chiksan Co., Brea, Calif., with territory comprising southern New York and northern New Jersey. The Black organization will handle the entire line of Chiksan and Weco products, including swivel joints, unions, tank-car and tank-truck loading arms and racks, marine and barge loading arms, and the Intelli-Giant hydraulic water monitor.

National Geophysical Shifts Peterson to Calgary Office

K. E. Peterson has been transferred to the Calgary office of National Geophysical Co. of Canada, Ltd., as a seismic supervisor, according to an announcement by W. R. Mitchell, executive vice president of the Canadian firm.

Peterson was formerly seismic supervisor in the Denver offices of National Geophysical Co., Inc. He has been with National 9 years.

Welex Jet Advances Brown and Hays

Fairest Brown has been appointed the assistant division manager of the Rocky Mountain division, and Ben L.

FAIREST BROWN

BEN L. HAYS

Hays has been named manager of the Farmington, N. M., district office of Welex Jet Services, Inc., officials of the oil-well service company have announced.

Brown will have headquarters in Denver, Colo., where Welex is opening a new division office. Brown has been with the company 4 years. Before serving as district manager of the company's district office in Pampa, Tex., he worked as a rigger and a shooter.

Hays, a veteran of 5 years of oil-and-gas service work, has been with Welex about 3 years. Prior to transferring to Farmington, Hays was assistant manager of the district office at Odessa, Tex.

The Farmington district represents the first expansion of Welex into the Rocky Mountain oil and gas fields. A second mountain-region district office will soon be opened in Colorado.

Weatherford, Magcobar, Schlumberger Host Study Group

The Weatherford Oil Tool Co. of Houston, along with the Magcobar and Schlumberger companies, was host recently to a group of 15 men from the School of Production Technology of Kilgore. The school is sponsored by the American Petroleum Institute in connection with the Petroleum Extension Service of the University of Texas. The curriculum of 7 weeks duration, is he'd at Kilgore Junior College and is open to anyone interested in the petroleum industry.

"The Golden Foot" is coming up!

During 1956 Core Lab will analyze its *millionth foot of core*. The sample may come from a well in Canada, or East Texas, or Venezuela. It may be one of hundreds of feet of core shipped thousands of miles from Saudi Arabia to Dallas.

It may be analyzed in Midland, New Orleans, or Farmington — or in any one of Core Lab's thirty-three permanent installations servicing all active drilling areas. While this event will be duly celebrated throughout Core Lab, processing the millionth foot will represent a momentous endorsement of core analysis as a basic science in the optimum development of reserves.

The first foot of commercial core analysis was performed to supply the missing link of reservoir information between "a rainbow on the slush pit" and non-quantitative measurements. Today, as we approach The Golden Foot, there is still no adequate substitute for surface evaluation of the basic product — the formation and its contents.

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DALLAS, HOUSTON, CORPUS CHRISTI, MIDLAND, ABILENE, SAN ANTONIO, TYLER, LIBERAL, FT. WORTH, WICHITA FALLS, SHERMAN, OKLA. CITY, TULSA, ARDMORE, BARTLESVILLE, PAMPA, ARK. CITY, GT. BEND, NEW ORLEANS, SHREVEPORT, HATTIESBURG, LAFAYETTE, DENVER, BAKERSFIELD, CASPER, BILLINGS, WORLAND, STERLING, EL DORADO, LUBBOCK, FARMINGTON, LOVINGTON, MONAHANS, SAN ANGELO, CALGARY, EDMONTON, REGINA, VENEZUELA, S. A.

EXPLORATION

Center of Gravity Shifts to Dixie

by Frank J. Gardner

"IF you were asked to name the single most important geological discovery of 1955, what would you say?" This question was asked of 20 prominent exploration men last month.

Almost without exception, the answer was the same: "Citronelle."

If you were asked to name our most likely future oil province, now unproductive or sparsely explored, what would you say?"

To this one, a heavy majority pointed a positive finger at the southeastern states.

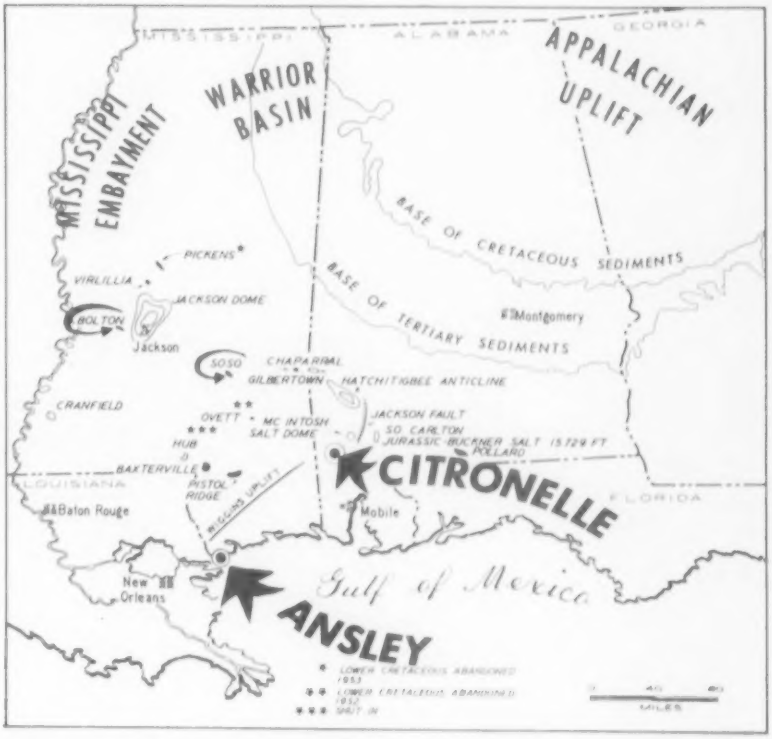
"Reservewise, what do you consider the most important strike in 1955?"

No exceptions here—offshore Louisiana.

The answers were not surprising, for in an exploratory year that can only be described as mediocre, there was little choice. Geologically, the choice was wide, for 1955 saw a score of geologically important strikes. Reservewise, the field was narrow, for not a single onshore discovery promised much barrelage for future reserves.

A shifting center of gravity . . . But the thing that strikes home is the emergence of Dixieland as our most likely future oil province, and the shifting center of gravity in exploration to South Louisiana. That lush Gulf Coast area has seized the national spotlight as far as new fields, new reserves, and fantastic success ratios (40 to 70 per cent) are concerned. It is far from being a **new** oil province, but its spectacular increase in activity and success is a 1955 exploration event to eclipse all others. It is a story of subsurface geology in "soft-rock" country.

And an important discovery . . . As the year ended, Marshall Young et al of Jackson, Miss., moved right up to the fence that separates Louisiana from Mississippi and made a "hard-rock" discovery that challenges geological thinking and heightens Dixie's interest even more. Ansley is its name. Young et al's 1 Cuevas heirs, on a Sun Oil Co. farmout in southwestern Hancock County, Mississippi, was the discovery well (Section 30-9s-14w). On production test last week, it flowed at a rate of 264 bbl. of 41.8°-gravity green oil per day through ¾-in. choke, plus 2,500 M.c.f. of gas per day; producing pay is Washita-Fredericksburg (Lower Cretaceous) perforated at 10,839½-51½ ft. At the moment, it is waiting on tanks for final potential test.



Two discoveries of 1955 were of great geological significance. Citronelle, in southwest Alabama, and Ansley, in southern Mississippi, were both Lower Cretaceous producers.

The real importance of this coastal strike is yet to be recognized, for it is believed to lie on a southwest limb or nosing off the west end of the Wiggins uplift, a regional anticline stretching across Mississippi's coastal counties in an east-west direction. Not much is known of the subsurface extent of the uplift, nor of its regional effect, but this discovery of good oil production on one of its flanks could have far-reaching effect on future Mississippi drilling programs.

It is known that the Tertiary sands of the coastal area sweep steeply upward against the uplift and that their feather edges may form potential traps. The Ansley discovery lends credence to the theory, for it went directly from the Heterostegina - Oligocene into Wilcox-Eocene sands, missing the entire Frio-Vicksburg section and the upper part of the Eocene (Jackson and Claiborne).

Indicate new campaigns for 1956 . . . Many operators look askance at the Lower Cretaceous search in the southeastern states, for experience so far indicates that exploration there turns into a search for porosity and permeability zones rather than for structure. They regard it as a "big-money" operation. But plans in the making by many companies indicate that they will take a searching second look with the newer geophysical tools throughout Mississippi, Alabama, Georgia, and northern Florida. The odds are even that many new fields are in the offing, and that 1956 will see another round of geologically significant strikes.

Why Some Geologists and Geophysicists Don't Mix

. . . and 12 steps that should be taken to see that they DO.

A working geologist traces the background of today's lack of coordination between exploration's two professions—and puts the blame squarely on management.

by Michel T. Halbouty

BETWEEN 1955 and 1975, we shall find oil pools in types of traps and under conditions that we don't even dream of today. But these new fields can be found only through the cooperative work of geologists and geophysicists. A joint geological-geophysical reexamination of old condemned areas could lead to the discovery of vast reserves not only in new provinces but in existing provinces. To achieve this, we **must** close the gap that has separated the two professions that are the exploration brains of the oil industry.

In the past year, a number of papers on this subject have been written by geologists and geophysicists. They carried these typical titles: "Geophysics to Stage Comeback";[1] "$2,000,000,000 Worth of Seismic Records—Is the U. S. Oil Industry Making the Most of this Investment?";[2] "Geophysical Activity Drops Again in '54—What Is the Remedy?";[3] "Better Seismic Interpretations Needed";[4] and "Exploration Staffs Can Succeed in Correlating Geological and Geophysical Data."[5]

It is healthy for geologists and geophysicists to become aware of shortcomings in their work and to try to correct them. Such measures will also prove to be most beneficial to the entire oil industry. As one writer put it:

"Geophysicists are convinced they can improve their skill in finding oil. Their formula calls for better interpretation of seismic findings and closer coordination with geologists."[6]

Management at fault . . . Geologists, I know, now want that coordination. But the alarming fact is that many geologists and geophysicists have not wanted to coordinate their efforts in the past. The further apart they stayed, the better they liked it.

This lack of coordination of exploration activities between the two professions is really the fault of management. The "Big Men-at-the-Top" should have forced the two professions to get together, whether or not the geologists and the geophysicists wanted to do so. They should have been forced to get together in the same room, discuss their respective data, coordinate it, and mutually submit the results.

Paul L. Lyons, past president of the Society of Exploration Geophysicists, ably stated the point when he said: "The men (management) who conceive such programs in which geology and geophysics are **intermixed,** not 'coordinated,' will be the oil finders of the future."[7]

A recent editorial in The Oil and Gas Journal had this to say about both of our professions: "Geologists and geophysicists deplore any suggestion that there is a 'gap' between them. But —call it what you will—there is a degree of rivalry, or prejudice, or self-centeredness which hampers the fullest coordination of their respective skills in the difficult task of finding oil."

There is no question that a very wide breach once existed, and I believe that a narrower one still exists. At times I'm inclined to think that it is as wide as ever. Nevertheless, this "misunderstanding"—and I'd like to refer to it as such—should be eliminated and should be replaced by coordination and cooperation.

How It Started

The wide gap that started between the two sciences was really not intentional. It happened because certain conditions unfortunately existed.

Prior to the discovery of Spindletop there were no petroleum geologists practicing as such. All of the geologists were professors and were retained by oil interests only when extremely necessary.

The great discovery of Spindletop in 1901 was the result of the faith of one man—Pattillo Higgins. The recognized geologists of that time condemned the prospect as unworthy of exploration. This historic discovery began to take the geologists out of the classroom and into the field as employes of oil operators.

Surface signs tempt prospectors . . . Higgins said there were surface indications which made him believe that oil existed in the area. These were listed as a mound or small hill which was quite perceptible above the flat prairie lands of the Gulf Coast, gas seeps that bubbled out of the ground, paraffin dirt that felt like rubber when squeezed in the palm of the hand, and sour waters in shallow wells.

These surface indications led to the drilling of the first well at Spindletop and then became the "signposts" sought in the search for other structures. Every prospector became a geologist. Someone remembered that a gas seep, or a mound, or sour water, or paraffin dirt, or a combination of these existed in some locality. Professional geologists were also employed by oil operators to seek out these same indications on a scientific basis.

So intensive was this search for surface indications that during the remainder of 1901, 11 domes were discovered. From 1901 to 1905, 29 more were discovered and 17 of these produced oil. From 1905 to 1924, the percentage of discoveries decreased to such an extent that the over-all cost of wildcat drilling became very unprofitable. In 1917 alone, there were 675 wildcat wells drilled for a total cost of $20,000,000 and only one dome was discovered. It proved to be unproductive.

Discovery rate falls . . . At the end of 1923, the discovery rate became so low in the Gulf Coast that many experts predicted that the known oil reserves would not meet the demand for oil for more than a few years. There were only 47 domes found by surface control wildcatting from 1901 to the end of 1923. Many were unproductive. Those that did produce penetrated only into the caprock. No serious attempt was made to find production on the immediate flanks of these structures.

So thoroughly was the Gulf Coast combed by geological crews that by the end of 1923, geologists frankly admitted they did not believe any more structures could be found by surface indications. The geologists themselves said that some other means had to be employed to find new structures in the Gulf Coast.

It was at this point, in 1924, that geophysics made its advent in the Gulf

Coast as a medium of exploration. So ended the first era of the geologist. With his meager tools of that time, he had done very well.

Geophysics appears . . . The success of geophysics was tremendous. In the 9 years from 1924 to 1933, 75 domal structures were found by geophysical instruments compared with the 47 that were found geologically or otherwise in the previous 23 years. Geophysics also proved that productive structures other than piercement-type salt domes existed on the Gulf Coast. The geophysicist supplanted the geologist. The first era of the geophysicist began.

It was at this point that the gap was created—neither the geophysicist nor management needed the geologist for exploration work. He was relegated to an "office boy" status. He brought the maps in and immediately was excused. It was not necessary for the geophysicist to have any geological data—his structures had from 400 to 1,000 ft. of closure. Fields like Hastings, Friendswood, and Anahuac were being found. Exploration in any other form was superfluous. Management became so geophysics-conscious that the geologist became a "forgotten man." This was management's great error. Years of valuable coordination of data were lost.

A wall is built . . . In dollars, the loss was staggering. Instead of training the geologist to understand the geophysicist and vice versa, a great wall was built between them. The geophysicist was successful. He didn't care about or consider the geologist. The ignored geologist fumed and waited.

The years from 1940 to 1945 were insignificant as geophysical discovery years. The war sapped brilliant manpower. After the war, geophysical discoveries continued to decrease. The Gulf Coast as a whole had been combed, and the structures with big closures were not to be found. Only deep low-relief structures with 25 to 50 ft. of closure were mapped, and most of these were drilled with disastrous results. Geophysical domination in exploration was rapidly coming to an end.

The Problem Today

In the meantime, the geologist had obtained more tools to work with and more data from drilled wells. He became more subsurface-minded and began interpreting the geology at various depths below the surface. When the geophysicist ran out of good areas to recommend for drilling, the geologist was ready with subsurface anomalies that he had worked out.

So management began to recognize the importance of the geologist once again and to ask for his recommendations. His subsurface control was based on sound data. When it was given to the geophysicist to check, the attitude of the geologist was "Let's see how good the geophysicist is **now.**" No spirit of coordination entered his mind. He recalled the years he'd spent as the forgotten man. Because of the different types of anomalies that can be mapped by the subsurface geologist, the geophysicist had difficulty in checking him and the battle was on again. The geologist made the same mistake the geophysicist made over 20 years ago. And management did nothing to eliminate this utterly childish reciprocal antagonistic attitude.

New oil-producing structures are now becoming more and more difficult to find. Those engaged in exploration must work together. The weakness in the coordination between the two sciences lies in certain basic areas which could so easily be eliminated. It is actually ridiculous for them ever to have existed.

Twelve Steps to Improvement

Observe what some of these areas are and some suggestions on how coordination could be achieved:

1. **Management must straighten itself out.** It must get its house in order. It must primarily bear in mind that an increase in discoveries and a decrease in exploration costs may only be realized by a close relationship between geologists and geophysicists. Management should make it compulsory for the two professions to work together on all exploration problems.

2. **The idea of having separate geophysical and geological departments should be eliminated.** It is absurd that in some companies, these two departments are even located in separate buildings and that contacts between individuals in these departments are sometimes negligible and at other times do not exist. One department should be organized. It should be called an "Exploration Department" and both geologists and geophysicists should be placed in the same rooms and under the same roof so that their ideas may be constantly exchanged.

3. **Eliminate fears through knowledge.** The geophysicist has a fear of interpreting, then recommending an unorthodox or completely new idea—such as thrust faulting in the coast—even though his records are full of multiple reflections. The fear lies in trying to convince his client or boss of something foreign to his usual interpretations. Lack of geological knowledge is a factor contributing to this fear. Geological coordination could clear up these interpretations.

4. **Strict geological coordination should precede the mapping of geophysical faults.** The geophysicist often maps a fault as a single line. In the majority of cases this is incorrect, and has led to the drilling of unnecessary dry holes. Faults are not merely straight lines representing a few feet on the contour map—they are zones consisting of one or several faults in which a relatively wide area has been affected. The accurate mapping of this zone is vital for locating the exploratory well.

5. **Combined geological-geophysical mapping should result in the location of lateral closures and stratigraphic traps.** The geologist's attitude of "Let's see the geophysicist find a stratigraphic trap" is wrong. The geologist should give the geophysicist all of the data available and help him locate such important traps.

It is impossible now for the geophysicist to locate this type of trap by geophysical data alone. Geophysics combined with geological data may reveal undiscovered facts that may lead to the accurate location of areas in which these traps may exist. This is one problem in exploration which certainly needs the utmost coordination between the two professions.

6. **Determine necessity for geophysical surveys.** It is recognized as most difficult to make usable seismic interpretations on the immediate flanks of piercement-type salt domes. Although an operator may request the geophysicist to conduct surveys on the flanks of these structures, the geophysicist should, by all means, discuss the proposed work with the representative geologist as to the necessity of conducting the surveys. In many cases, seismic surveys on the immediate flanks of these domes would be a waste of time and money, and the results would be confusing and inconclusive.

Such surveys should not be recom-

THE AUTHOR

Michel T. Halbouty, an aggressive wildcatter and independent oil operator, is a graduate of Texas A. & M. College. His first job was with the Yount-Lee Oil Co. in 1931 as junior geologist. Later, he served as chief geologist and petroleum engineer for Glenn H. McCarthy. In 1937, he entered the consulting field. He is an authority on Texas Gulf Coast geology, where most of his drilling activities have centered, but his field of experience covers the entire nation. Recently he co-authored the best-selling book, "Spindletop."

This paper was presented before the thirty-third annual meeting of the Louisiana-Arkansas division of the Mid-Continent Oil and Gas Association, New Orleans, under the title "A Geologist's View of Present-Day Geophysical Interpretations."

mended by the geophysicist. Although a contract for geophysical work could be had for the asking, the geophysicist should not accept such work if, in his opinion, the results would not be satisfactory and conclusive. (Note: This reference applies only to geophysical work that is authorized on the flank of the dome very near the salt plug. The reference does not apply to off-flank areas located some distance away from the dome.)

7. **The geophysicist needs to obtain a better knowledge of regional and local geology of the area to be explored.** This is an important requirement because in the client-contractor relationship, the geophysicist may be too eager to please and may not argue his convictions enough when they are in conflict with those of the geologist. A knowledge of the regional and local geology would enable the geophysicist to argue his point well.

8. **The geologist needs to learn more about geophysics and its problems.** Continuous studies with geophysicists and numerous discussions would help him coordinate his work better with that of the geophysicist.

9. **A coordination session should precede entry into the field.** The geophysicist has for years been making interpretations without due regard to geological facts existing in the subject area. No geophysical crew should enter the field without its party chief and/or its interpreter first having consulted the representative geologist. A coordination session should take place where they may exchange ideas.

The geologist should have already prepared cross-sections showing all formations down to the required depth and giving the physical properties and thicknesses of these formations. The geologist should also prepare maps showing the regional geology with all known faults and other pertinent geological conditions. Well control, such as log correlation, electric-log characteristics, and representative electric logs of wells in the general area should be discussed, and all of these data made available to the geophysicist for his continued use. Then,

10. **The first few geophysical records should be brought in to the geologist and thoroughly discussed with him.** The geologist should check the records against his geological cross-sections and other data. Then the geologist and geophysicist should discuss together the results obtained from these records. Emphasis should be placed on accuracy centering around detailed velocity control and more accurate velocity functions with a continued coordination with the geological data.

11. **Successive meetings of the geologist and geophysicist should be held as the geophysical survey progresses.** Every effort should be made during these meetings to coordinate the joint data.

12. **Progress maps, and certainly the final geophysical interpretation, must be made by both the geologist and geophysicist.** This is extremely important. Each contour and fault should be discussed, weighed, and agreed upon by both men before being mapped. The result would be a coordinated effort of two professional sciences.

If the area is condemned, it is mutually condemned, and the operator has the benefit of the thinking of a coordinated exploration team.

If the area is approved for drilling, it should be a mutual conclusion. In the long run this will result in more oil being found. These men would become oil finders instead of critics of each other's work and importance. The operator, the industry, and the consumer would profit.

When the gap between these two great professions has been closed by cooperation, coordination, and the joint use of imagination, the plain good "horse sense" of pulling together toward a common goal will result in more accurate structural and stratigraphic in-

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terpretations and the finding of more oil and gas. This accomplishment will serve the public and all mankind.

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EXPLORATION HIGHLIGHTS

APPALACHIAN

PENNSYLVANIA

In Banks Township, Indiana County, Southwest Pennsylvania Columbian Carbon Co. 1831 Farmers & Miners Trust Co., is shut down at 1,071 ft., to move in a rotary outfit.

● In Young Township, Manufacturers Light & Heat Co. 4336 Stewart and R. & P. Coal Co., is drilling at 872 ft.

WEST VIRGINIA

St. George district, Tucker County, West Virginia, Columbian Carbon Co. 1219 U.S.A. was fractured in the Oriskany sand with no gas and remains shut down.

● Greenbank district, Pocahontas County, this company is moving from 1220 U.S.A., which has been shut down indefinitely at a depth of 3,300 ft., to a new location.

OHIO

The producing area in western Perry Township, Coshocton County, was ex-

Index to area reports

Appalachian	151
Mid-Continent	153
Hugoton Embayment	155
West Texas-New Mexico	155
Pacific Coast	156
Great Lakes	156
Rocky Mountains	156
Gulf Coast	157
Southwest Texas	158
Southeastern States	159
Western Canada	159
Successful Wildcats	159

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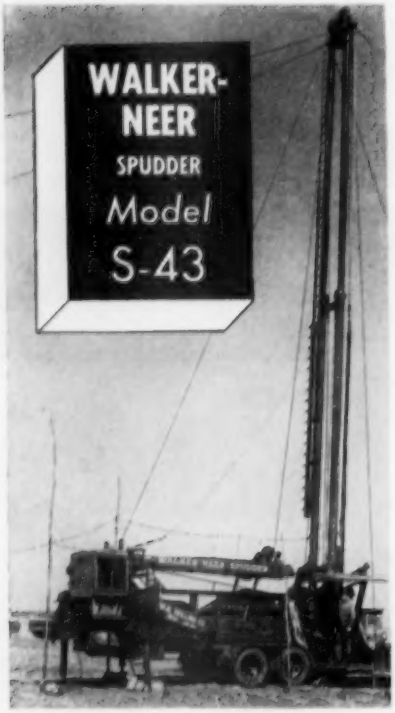

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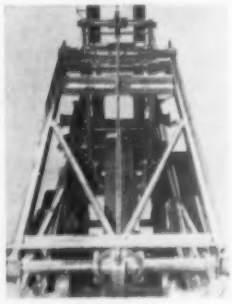
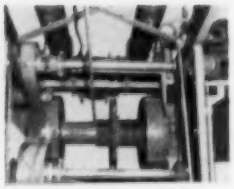
For 3000-Foot Drilling, 4000-Foot Workover



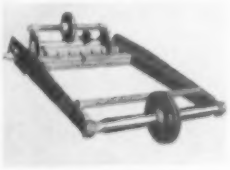
WHIP ACTION—FOR FASTER DRILLING

The more SNAP, in cable-tool drilling, the faster you make hole! Walker-Neer's WHIP ACTION is the snappiest, most powerful spudding action yet developed. Whip Action is the result of two Walker-Neer advancements: V-belt-driven band wheel, replacing rigid, gear drives; and the revolutionary "Tor-Shock" (Rubber Torsion) Shock Absorber, built into the spudding beams.



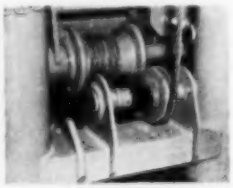
FULL WIDTH CALF REEL

This feature minimizes piling up and cutting in of wire rope on the calf reel . . . assures you top efficiency in well completion and all workover operations. This, combined with Whip-Action Drilling, places the S-43 in a class to itself for versatility.



NOISELESS DRILLING

The "Tor-Shock" Shock Absorber performs two functions; snaps the tools, and cushions every stroke. In addition—each drive, including sand reel, is separately controlled. Two sets of V-belts, no other drives, operate while the S-43 is drilling. There's no noise to shout over, and excessive wear is eliminated.



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You save stringing-up time. The mast-raising line remains strung up on a separate drum, and the mast is raised or lowered in a minute or so. The worm shaft and worm wheel on this drum prevent free spooling and the possibility of dropping the mast—a valuable safety feature.

ROTARY ATTACHMENT EASILY ADDED

A rotary attachment can be installed on the S-43 by simply adding a clutch on the counter shaft that drives the tubing drum—no new shaft is needed.

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Walker-Neer Spudders include three basic designs and 14 models—one for every need. Capacities range from 500' to 10,000' drilling, and up to 14,000' workover. Write for literature.

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tended ½ mile further east by one of its best wells. On 1 A. E. Crowthers, Section 14, and completed by Mutual Oil & Gas Co. the Clinton was found at 3,173-3,225 ft. with a good showing natural and 425 bbl. in 24 hours after fracturing.

● Natol 2 Glenn Willey, Section 5, Fallsbury Township, Licking County, an outside location to the Mt. Zion pool, gaged 70 bbl. in a 24-hour test after fracturing the Clinton, logged at 2,966-3,010 ft.

● Layland pool was found to extend over into Monroe Township, Coshocton County, by Ditch and Hanna with their completion on 1 J. B. Mohler, Section 1. Clinton at 3,580-3,624 ft. gaged 625,000 cu. ft. gas and a show of oil natural and 825,000 cu. ft. and 70 bbl. oil in 24 hours.

MID-CONTINENT

OKLAHOMA

New Wells Enhance Grant Trend's Value

The fast-growing basal Pennsylvanian sand oil and gas-distillate trend in northern Oklahoma's Alfalfa and Grant counties received more important additions last week.

Midstates Oil Corp. 1 Weber in SW SE 9-28n-8w, Grant County, flowed 14 bbl. of oil per hour on test of perforations at 4,868-78 ft. Woods Petroleum Co. added the second oil well at new Northeast Wakita field in Grant County at 1 Harper in C SW SW 18-28n-6w. The well flowed 4 bbl. per hour on 24/64-in. choke from perforations at 4,866-85 ft., natural. Sunray Mid-Continent 1 Ancell in C SE NW 12-28n-9w, in Alfalfa County's sector of the Eureka district, is testing perforations at 4,947-57 ft. The well made 3,690 M.c.f. of gas per day on ¼-in. choke.

Powel Briscoe has a new pool discovery well at 1 Wycoff, C NE NW 25-28n-6w, south of South Prairie Home oil field. The well flowed 1,500 M.c.f. of gas per day on a test of the Cherokee sand at 4,747 ft.

New Producing-Depth Record Being Set

British American Oil Producing Co. is setting a new producing-depth record for Oklahoma at a deep Knox field test in Grady County.

The 2 Harrison, SE NW NE 29-3n-5w, flowed 7,590 M.c.f. of gas per day on test of the deep first Bromide sand at 14,931-15,013 ft. The old depth record for the state was Denver 1 School Land in Cogar field, Caddo County. That well, back in 1948, found gas in the Hunton lime at 14,510 ft. The deepest oil production in the state is in the Bradley district of Grady County at Max Pray et al 2 Billy. That well, completed last year, flowed oil from the Tulip Creek sand at 14,076 ft.

Sixty-Six Wells Producing At West Short Junction

Cleveland County's West Short Junction Hunton lime field now has sixty-six oil wells. The latest two additions to the prolific field are: Skelly Oil Co. 2 Traub in C SE SE 23-10n-4w, and

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SUCKER ROD PUMPING RESEARCH, INC.

This is an invitation to each interested party to participate as a stockholder in Sucker Rod Pumping Research, Inc., a non-profit group organized to solve the sucker rod pumping problem.

OBJECTIVE

1. To construct and instrumentize a simulator for complete sucker rod pumping systems. A complete system includes prime mover, pumping unit, rod string, pump, tubing, fluid column, and lead line.
2. To develop, from measurements taken on the simulator, as simple and as direct a method as possible for determining **prime mover horsepower, peak crankshaft torque, required counterbalance, peak polished rod load, polished rod horsepower, and plunger stroke** for any specific set of well conditions within the present and foreseeable future range of application of sucker rod pumping.
3. To develop a system of graphs and charts that will permit quick and accurate selection of the size of pumping unit, prime mover, and subsurface equipment to do a given job.
4. To provide a catalog of dynamometer cards for the hundreds of conditions that will be put into the simulator to solve the problem.

CHARTERED in the State of Delaware January 18, 1954, Sucker Rod Pumping Research, Inc., has a present membership of twenty-nine companies.

PARTICIPATION in this research project is open to any individual, company or group interested in reducing the cost of artificially lifting fluid from wells, in accurately sizing the various components of sucker rod pumping systems, and in operating such systems in the most productive and economical manner.

FINANCING of the research program will be accomplished from a fund of not less than $100,000 contributed by the various participants in a total amount per participant of not less than $2,500 or more than $5,000.

PERSONNEL. Salaried personnel have to date been limited to one part-time secretary and one part-time accountant-bookkeeper with only a nominal monthly expense.

ACCOMPLISHMENTS TO DATE include selection of the type of simulator for the sucker rod pumping system, development of the basic equations for designing the simulator, and preparation of an inquiry that was sent to qualified organizations. The inquiry outlined the sucker rod pumping problem, stated the objectives of the program, specified the range of depths, pump sizes, strokes, strokes per minute, etc., over which the problems are to be solved; specified the loads and displacements that must be measurable; specified the type of simulator to be constructed, and presented the basic equations for the design of the simulator. Nine proposals were received in answer to the inquiry. These proposals were analyzed and Midwest Research Institute was selected to do the work. Midwest Research Institute is now designing the simulator.

As a producer or manufacturer, your immediate attention is solicited.

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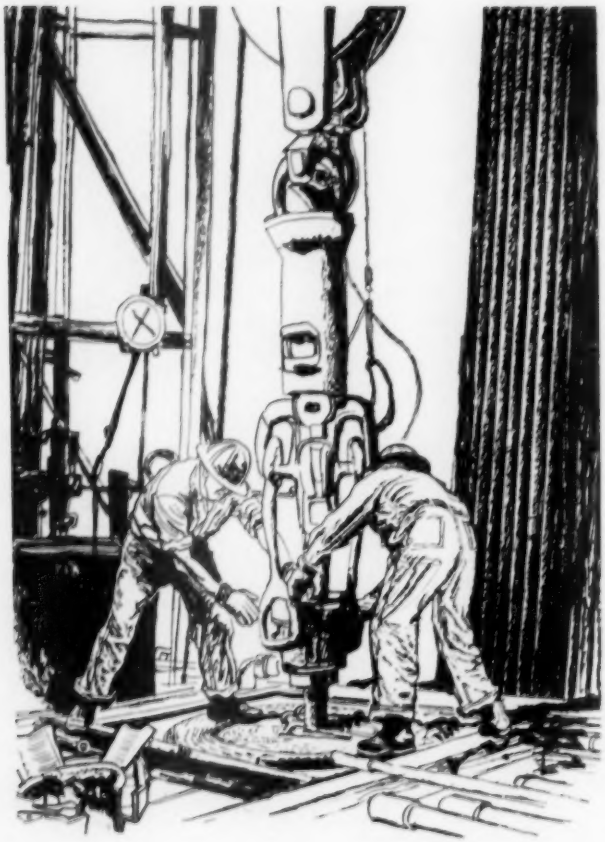

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"SAVING $1.00 PER FOOT OF HOLE"

Contract driller H. V. Middleton's two TORQMATIC-equipped Franks "Comet" rigs have drilled about 130,000 feet of hole to date.

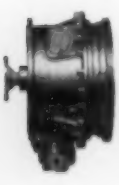
"My whole operation's both faster and cheaper now," the veteran wildcatter reports. With Allison TORQMATIC Converters delivering smooth, *shock-free* power to draw works and rotaries, maintenance costs are way down. The Converters haven't cost one cent for repairs. In fact, *all* repairs are fewer.

"I figure I'm saving about $1.00 per foot of hole over my previous rigs," Middleton reports.

That includes a 25% saving in the cost of moving his rigs. On a recent job—a typical one—he set up in 16 hours; tore down in 8. His saving on the 35-mile move: $4,000 over older type rigs.

What's more, Middleton has found quick-responding TORQMATIC operation ideal for fishing. The ability to control a move of just one or two inches means far less chance of "losing the fish." And in regular drilling, there's far less chance of "twist-offs."

You can get Allison TORQMATIC DRIVES in drilling, servicing and fracturing equipment made by most leading manufacturers—or as replacement units for your present rigs. For the rest of the story, check your dealer, equipment manufacturer—or write to Allison Division of General Motors, Box 894R, Indianapolis 6, Indiana.



GM TORQMATIC Allison TORQMATIC DRIVES

Benson and Montin et al 1 Williamson in C SW SE 9-10n-4w.

The Traub well was completed to flow at the daily rate of 278 bbl. on ¼-in. choke from perforations at 8,056-96 ft. The Williamson well flowed 318 bbl. of oil per day from perforations at 8,022-62 ft. on ¼-in. choke.

KANSAS

Testing Due at New Harper County Discovery

Cable tools are being rigged up at an indicated Mississippian discovery in northwestern Harper County. Rupp-Ferguson Oil Co. 1 Miller, SW SW SW 2-31s-9w, 2 miles west of Grabs pool, gaged 635 M.c.f. of gas and recovered 105 ft. of mud on a test at 4,412-27 ft. On another test at 4,427-53 ft., the final one, recovery was 55 ft. gas-cut mud, 60 ft. slightly oil and gas-cut mud, 110 ft. oil and gas-cut mud and 10 ft. very heavily oil-cut mud.

Clean Oil Tested at New Cowley Discovery

W. M. Pitts 1 Warren, S½ SW NW 15-35s-5e, 2½ miles southeast of Silverdale gas field in southern Cowley County, recovered 2,300 ft. free oil on a test of the Mississippian at 3,164-78 ft. A test of the Cleveland sand at 2,675-2,715 ft. recovered 480 ft. oil and gas-cut mud and 1,200 ft. water.

Testing Under Way at Barber Gas Strike

Testing continues at a new Barber County gas discovery, Ed Adair and Carter Oil Co. 1 Blunk, S½ SW NW 30-34s-13w, 6 miles west of Hardtner pool and 8 miles northwest of the town of the same name.

The well gaged 3,000 M.c.f. of gas per day from open hole at 4,727-43 ft. in the dolomite after fracturing.

HUGOTON EMBAYMENT

SOUTHWEST KANSAS

Mississippian Gas Tested At Extension Prospect in Kiowa

El Dorado Refining Co. is testing Mississippian gas shows at 1 Kinnery, NW NW SE 16-28s-16w, 1 mile west and ½ mile south of Herring pool in eastern Kiowa County.

The well gaged 5,000 M.c.f. of gas per day on a drill-stem test at 4,723-38 ft. in the Mississippian. A test in the conglomerate at 4,693-4,718 ft. gaged 3,700 M.c.f. per day.

OKLAHOMA PANHANDLE

Chester Gas Discovery Tested in Mocane Area

The Texas Co. has a Mississippian-Chester lime gas discovery west of the Mocane region in Beaver County. The 1 Gulf Coast Western A in C SW NE 9-5n-24eCM, flowed 7,450 M.c.f. of gas per day through open 2-in. tubing after treatment of perforations at 6,410-32 ft.

Morrow to Be Tested At Harper County Well

The Morrow-Penn sand will be tested at a new East Laverne area wildcat prospect in Harper County. Magnolia Petroleum Co. 1 Stinson, C NE SW 12-26n-25w, north of the East Laverne area, will be tested in the Morrow sand penetrated at 7,200 ft.

The well is west of the Stockholm field area. Here, Sinclair Oil Gas Co. 1 Gebhart, NE SW NW 14-26n-24w, flowed 621 M.c.f. of gas per day on a 1-hour test of the lower Tonkawa-Penn at 5,553-68 ft.

TEXAS PANHANDLE

Confirmation to Rehm Field Preparing to Complete

The confirmation well to a 1954 discovery in the Dalhart basin is preparing to complete in the granite wash at 6,115-17 ft.

The well is Standard Oil Co. of Texas 2 Ernest Guilloud in Section 54, Block I.E., Gunter & Munson Survey, 11 miles southeast of Middlewater in Hartley County, Texas. The well swabbed at the rate of 55½ bbl. of oil in 5½ hours from open hole in the granite wash. The Rehm field discovery well, 1 Guilloud, opened first oil production in the Dalhart basin in 1954.

WEST TEXAS-NEW MEXICO

WEST TEXAS

Completion Potentials In As Year 1955 Closes

The year's end saw several West Texas wildcats completed which have been in the testing stage for some time.

In Dawson County, about 8 miles west of Lamesa, Drilling & Exploration Co., Inc., et al 1 Wells finished as a heavy flowing Devonian discovery. This well was previously completed dry at total depth 9,763 ft.

New total depth was 12,102 ft., with top of Devonian at 12,014 ft., and top of pay at 12,083 ft. Elevation was 3,044 ft. On completion test through 16/64-in. choke, the well made 902 bbl. of 37° oil a day. Tubing pressure was 225 psi., and gas-oil ratio was low at 20:1. Other markers were the Pennsylvanian reef at 9,612 ft., and the Mississippian at 11,594 ft.

Ector County . . . DeKalb Agricultural Association 1 J. E. Parker (originally filed as Williamson & Roden 1 Parker), has been plugged back from 12,630 ft., to make a Clear Fork discovery.

Potential on the pump was 131 bbl. of 37° oil a day, from perforations at 5,562-5,780 ft. Top of the Ellenburger was 12,445 ft., on elevation of 3,152 ft. DeKalb took over at 12,630 ft. for completion. Location of the new well is 6 miles northwest of Penwell, and 3 miles west of Grayburg production in Harper field.

Tom Green County . . . John J. Eisner 1 Powell, 11 miles southeast of San Angelo, completed as a flowing well from a shallow unidentified sand, and at this report a north offset was running pipe for tests.

The discovery flowed 302 bbl. of 40° oil a day through 16/64-in. choke, under tubing pressure of 36 psi., and with gas-oil ratio of 565:1. Pay was perforated at 3,867-75 ft.

The offset is Hiawatha Oil & Gas Co. 1 Powell, which had pipe set at 3,884 ft.

Borden County . . . Midwest Oil Corp. had a flowing Strawn discovery at 1 Joe Scott, wildcat 14 miles northeast of Gail. On test at 7,744-71 ft., gas surfaced in 5 minutes, mud in 29 and oil in 32 minutes. Estimated flow rate was 20 bbl. an hour, for 28 minutes. Flowing pressure ranged from 775-2,225 psi. The well unloaded on the way out, and there was no water in drill pipe recovery.

A second test from 7,771-7,814 ft. had mechanical troubles. Operators circulated out 680 ft. of mud with no shows, and drilled ahead.

Location is in Section 413, Block 97, H&TC Survey, 3 miles west of Pennsylvanian production in Myrtle field. Top of the Strawn line at 1 Scott was 7,746 ft., minus 5,179 ft.

NEW MEXICO

Lea County Wildcat Flows Wolfcamp Oil

Humble Oil & Refining Co. 1 South Four Lake Unit, in 2-12s-34e, east of Bagley field, ran a drill-stem test in the Wolfcamp from 9,870-99 ft. Gas surfaced in 3 minutes, at the rate of 2,500 M.c.f. per day, oil reached the top in 9 minutes and flowed at the rate

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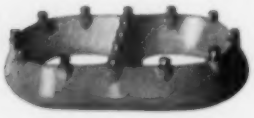

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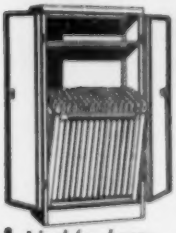

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of 84 bbl. an hour for the balance of the 1-hour test. Flowing pressure ranged from 1,760-3,150 psi., and 30-minute shut-in pressure read 3,665 psi. Oil was 39.7°-gravity.

Operators drilled ahead on a 13,000-ft. Devonian contract.

PACIFIC COAST

CALIFORNIA

New Field Discovery For Los Angeles

Richfield Oil Corp. completed 1 Boyle Industrial on the fifth redrill for a new discovery in the Boyle Heights district of Los Angeles. A total of 17,983 ft. of hole was drilled on this test with the deepest penetration being 6,530 ft. on the fourth hole. It was completed flowing at the rate of 170 bbl. daily of clean 25.7°-gravity crude through a 12/64-in. choke from the perforated interval 3,116-3,488 ft. This discovery is only 4 miles southeast of the Los Angeles City Hall in a heavy industry district. Richfield has 1,500 leases covering 500 acres in this area.

Another East Strand Field Test Fails

Shell Oil Co. chalked up another miss on an attempt to extend production of its recent two pool discovery in East Strand field of Kern County. This latest abandonment was the 9,970 ft. deep 21-9 KCL ¼ mile southeast of the discovery. Just 2 weeks ago the operator abandoned 74-8 KCL, a 9,969 ft. test located 1,000 ft. southwest of the discovery. The discovery well 83 KCL, was dually completed in the two pools last August for 435 bbl. daily of 33°-gravity oil. It is producing from the first Stevens zone at 8,090-8,100 ft. and the "83" sand at 9,771-9,851 ft.

Recompleted Sunset Beach Well Put on Production

The deepened Eddie Fisher 1 Merrill Community in the Sunset Heights area of Sunset Beach field, Orange County, has been completed flowing and pumping 403 bbl. daily of 28.1°-gravity crude from three perforated intervals. The operators deepened this well located NW NE 29-5s-11w, from its original completion depth of 7,000 ft. to 7,990 ft. It is now producing from the perforated intervals 7,843-82, 7,892-7,900 and 7,914-50 ft. It was originally completed last April in the interval 6,260-6,315 ft. from which it produced 55 bbl. daily of 32.8°-gravity crude.

Deep Test Planned Near Famed Gusher

Standard Oil Co. of California was moving in a rotary for a deep test on a site just a few feet northeast of the famed Lakeview gusher in the Midway-Sunset field, Kern County. The Lakeview gusher was completed in 1910 flowing 68,000 bbl. daily from a total depth of 2,228 ft. It flowed 8,000,000 bbl. between March 15, 1910, and September 9, 1911.

GREAT LAKES

MICHIGAN

Results of additional production testing have been more encouraging at John W. Johnson 1 Clemons, SE NW SE 16-9n-9e, Marathon Township wildcat, Lapeer County, a possible new Berea oil discovery well.

This wildcat, now being flowed about 12 hours a day, is producing an average of 40 bbl. of fluid, of which approximately 10 bbl. treat out as acceptable pipeline oil.

Production testing was hampered earlier by an emulsion block which appeared to have developed from the type of oil base used in a sand fracturing treatment. Enough fluid has now been recovered to equal all of the fluid used in the fracturing and follow-up fracturing operation. Not all of the emulsion has been cleaned from the well bore and pay, but it is expected, on the basis of these most recent tests, that as additional fluid is recovered the oil will improve in quality.

The 1 Clemons, Johnson's second Berea objective test this year in the Marathon play, both of which showed considerable free oil natural, logged top of Berea sand at 1,449 ft. Hole was drilled to 1,467 ft., total depth. Gas shows were logged at several points between the top and the total depth. Oil pay came in at about 1,465-67 ft.

It is expected that the encouraging results obtained at the 1 Clemons, following sand fracturing treatment with 5,000 gal. oil and 10,000 lb. sand, will stimulate additional development in this shallow sand area early in 1956.

ROCKY MOUNTAIN

MONTANA

Wolf Springs Confirmation Tested

Atlantic Refining Co. recovered oil at the rate of 45 bbl. per hour on drill-stem test of a second well in Wolf

Springs field, Yellowstone County. The well, 2 Horton estate, C SE NW 18-7n-32e, flowed at the 45 BOPH rate for 12 minutes of a 39-minute drill-stem test at 6,088-6,116 ft.

Test was in Amsden. Flowing pressure was 2,375 psi. at the end of the 39-minute test, and shut in pressure was 2,775 psi. after 15 minutes.

The well is ½ mile north of the Wolf Springs discovery, 1 Horton estate, C SE NW 18-7n-32e, which was completed earlier this year for a flow of 386 bbl. of oil per day through 12/64-in. choke. The current well is reported to run 13 ft. higher structurally than the discovery.

The Montana Oil & Gas Conservation Commission has recently set a 160-acre pattern for future drilling to Amsden in this central Montana field. The Wolf Springs discovery is 24 miles south of Amsden production in the Northwest Sumatra area, and is regarded as one of the most important 1955 developments in the state.

NORTH DAKOTA

Pipe Run at Divide County Wildcat

Phillips Petroleum Co. and R. M. Ballard has run pipe at 1 Braathen, NE NW 29-162n-95w, Divide County. Casing was landed at 7,153 ft. The well had shows in both Charles and Mission Canyon. It is 20 miles north of Tioga field production. Operators are last reported waiting on cement.

Shows Recovered at Bottineau County Wildcat

Farmers Union Central Exchange recovered 30 ft. of highly oil-cut mud, 60 ft. of oil-cut mud and 120 ft. of oil and mud-cut water on drill-stem test of 1 Stenehjem, SE SE 15-161n-82w, Bottineau County. The well is 9 miles east of Mohall, and 12 miles southwest of Westhope field. Test was of the interval 4,152-68 ft. in Mission Canyon. The area has had little previous drilling but some previous shows which later went to water and were not commercial.

WYOMING

Carter to Drill Rank Powder River Basin Wildcat

Carter Oil Co. has made location for 1 Government-U.S.A., SE NW NE 11-51n-75w, in the Barber Creek area of Campbell County. The well is northwest of Gillette, and is to test Mesaverde at about 6,500 ft. This portion of the Powder River basin has had little previous drilling. Nearest previous well to the current Carter location is a failure by Gulf Oil Corp. which was drilled north and a little west of the town of Gillette to total depth of nearly 11,000 ft.

NEBRASKA

Completion in Progress at Garden County Discovery

Brinkerhoff Drilling Co., Denver, is setting tanks and putting on pump at 1 Richards, C NE NE 28-17n-43w, Garden County. The well was swabbed at the rate of 20 bbl. of fluid per hour, with cut varying from 2 to 20 per cent water. The well is the first apparent producer for Garden County, and is 20 miles northeast of previous production in the Denver-Julesburg basin. It is 2 miles east of the town of Oshkosh.

GULF COAST

SOUTH LOUISIANA

New Deep-Sand Production Found in Terrebonne Parish

Potential flow of Superior Oil Co.'s deep gas-condensate discovery well 1 Harry Bourg, 2 miles southwest of Bayou DeLarge field, in Terrebonne Parish, is rated at 8,911,000 cu. ft. of

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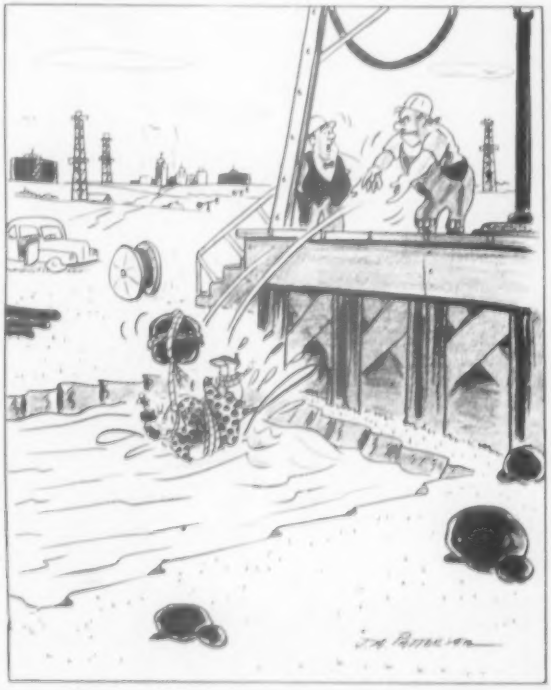


"How many times, Moreley, must I tell you not to let your domestic troubles interfere with your work?"

gas and 170 bbl. of 46.7°-gravity condensate per day. Flow through 9/32-in. choke was 5,087 psi. Pay is perforated at 14,982-14,994 ft. Hole was drilled to 15,881 ft.

Indications of production also have been given in another Terrebonne Parish wildcat, located 2 miles southeast of Deer Island field, 25 miles northwest of the Bayou DeLarge area. This discovery is by Humble Oil & Refining Co. at its 1-W LL&E. In a drill-stem test of sand at 13,640-45 ft., recovered 5½ bbl. of oil through ⅝-in. top and ¼-in. bottom chokes with a 7,000-ft. water cushion. Bottom-hole pressure was 9,855 psi., initial, and 9,855 psi., final. Shut-in bottom-hole pressure was 11,475 psi.

Hole has been deepened to 14,018 ft., and oil string run through the indicated pay to 13,680 ft.

Major Area Indicated in Manila Village Discovery

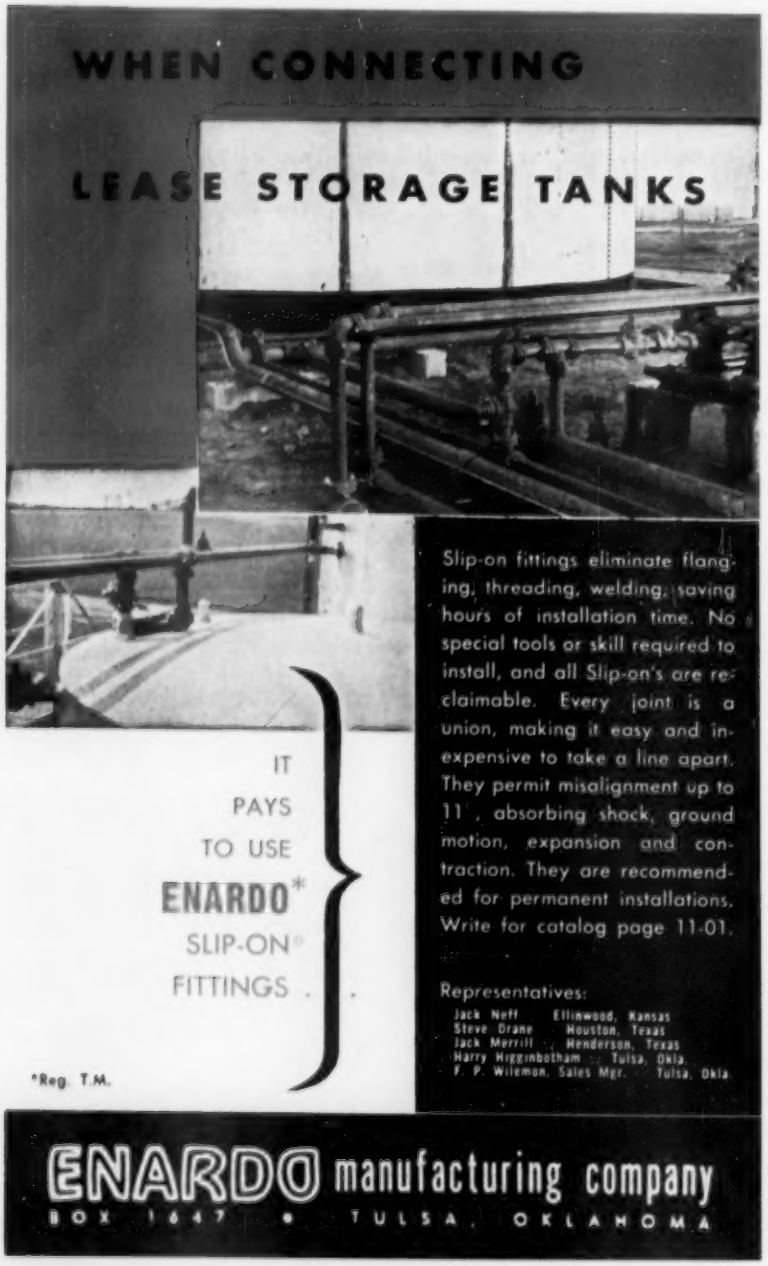
Tide Water Associated Oil Co. appears to have uncovered its long-sought main oil-producing sector in the Manila Village area, in Jefferson Parish.

Moving across a major fault with its sixth test, it has completed a dual-zone oil producer. Both pays are new for the area, one being perforated at 10,197-99 ft., and the other at 9,838-40 ft.

From the lower zone, the well produced at the rate of 246 bbl. of 24°-gravity oil per day through 9/64-in. choke with pressure of 1,400 psi. and gas-oil ratio of 655 cu. ft. per barrel. From the upper zone, flow rate was 267 bbl. of 30.2°-gravity oil per day through the same sized choke with pressure of 1,500 psi. and gas-oil ratio of 735 cu. ft. per barrel.

Tide Water's discovery well was drilled in 1948. When completed it was the highest pressure oil well on the Gulf Coast, its bottom-hole pressure being calculated at 12,635 psi. The second test was dry. The third (1 Hassinger) was completed originally as an an oil producer, but went to water. It was deepened and recompleted as a gas well, now shut in. The fourth test was dry. The fifth is a shut-in gas well.

Location of the field is on a 4,700-acre block in the St. Denis Bayou area on the northern edge of Barataria Bay. Gulf Refining Co. has a 27 per cent interest with Tide Water.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SOUTHWEST TEXAS

New Wildcatting Scheduled In Southwestern Counties

Significant new wildcat drilling is projected in at least three Southwest Texas counties.

In Travis County, W. H. Beadles and associates, of Fort Worth, have a location for a proposed 12,000 ft. test. Location is at 1 Rasanky, in the T. Ellison Survey, 6½ miles northeast of Mantor, in the northeastern part of the county.

In far-southwestern Val Verde County, R. J. Carroway and associates, of Dallas, will drill a deep test at 1 Whitehead, 4 miles east of Vinegarone, in the northeastern corner of the county. Location is in Section 8, Block B, C&M Survey. Location is east of the Vinegarone Strawn sand gas-condensate area, revived in 1955 by deep, extension discoveries southeast of the original area by Phillips Petroleum Co. and Humble Oil & Refining Co. Carroway's test scheduled to go to 11,500 ft.

Kirkwood & Morgan, Inc., and McCabe & Turner will drill another wildcat, No. 3, on their Halsell Ranch block, in far-southwestern Maverick County. Location is in Section 29, Block 11, I&GN Survey, about 22 miles

southeast of Eagle Pass, and about 12 miles southeast of their second test on the Halsell Ranch. The latter recently was quit at 4,004 ft.

SOUTHEASTERN STATES

SOUTH MISSISSIPPI

Second Test Started After Hancock County Discovery

Marshall Young and associates have moved their rig from their new deep discovery well near Ansley, in the southwest corner of coastal Hancock County, to another rank wildcat location about 10 miles northeast in the same county. The new test, 1 Stem, in 22-8s-15w, also is on a Sun Oil Co. "farm-out."

The Ansley discovery well, 1 Cuevas heirs, in 30-9s-15w, has been shut in pending installation of additional tankage. On a 12-hour gage through ¼-in. choke, it flowed at the rate of 264 bbl. of 41.8°-gravity oil with 2,500,000 cu. ft. of gas per day. Flowing pressure was 1,750 psi.

Pay, in the Washita-Fredericksburg section of Lower Cretaceous age, is perforated at 10,939½-51½ ft. Total depth is 10,924 ft.

WESTERN CANADA

ALBERTA

Devonian Discovery Reported In Shining Bank Area

A Devonian crude oil discovery has been reported in the Shining Bank area of central west Alberta.

Union Oil Co. of California reported the strike at a wildcat venture it is operating and continuing to core and test. It is located 14 miles north of Peers railpoint and 100 miles west of Edmonton.

This well, Union-Anglo-Kroy-Stanolind 16-23 Shining Bank, is located on LSD 16, 23-56-14w5. It is 9 miles west-northwest of the Kroy-Anglo 17-7 East Mahaska unsuccessful exploratory test and the same distance north-northwest of the Richfield-H.B. 1 Carrot Creek wildcat abandonment.

Union Oil Co. is the operator of the test well and others with a direct interest in the venture are Canadian Oil Companies, Ltd., and Kroy Oils, Ltd. The test is being drilled on lease rights acquired by the team under farmout agreement with Stanolind Oil & Gas Co.

The discovery drill-stem test was run of the D1 interval of 8,025 to 8,060 ft. with the valve open 60 minutes and shut in 20 minutes. When the pipe was pulled it contained 210 ft. of oil, 1,380 ft. of water cushion, 150 ft. of gassified oil which blew from the pipe during pulling operations and 90 ft. of clean green oil. Oil recovered was graded at 40°.

Flush Flow Rate Reported at Harmatton

Oilwell Operators-C&E 1-7 Harmatton, a prolific light-gravity Mississippian discovery 6 miles south of Westward Ho field, flowed 4,500 bbl. daily during tests late last month. The flush producer is located on LSD 1, 7-32-4w5, 46 miles northwest of Calgary.

The well indicated a gross pay section of 80 ft. It has been placed on production with an interval of 15 ft. of pay open. During the first 1-hour test, through casing on 48/64-in. choke, the well produced 188 bbl. of oil. The next test, of 1 hour and 30 minutes duration, produced at the rate of 68 bbl. hourly on 24/64-in. choke. A 2-hour test on 26/64-in. choke made 66 bbl. per hour. The final test, a 1-hour test, made 100 bbl. of oil on 30/64-in. choke.

This well is operated by Home Oil Co., Ltd., with a 60.75 per cent stake in the test, and a 72,000-acre spread on which it is located. The other interests are: Trans Border Oil, Ltd., Alminex, Ltd., and Calgary & Edmonton Corp.

New Wildcat Planned For Wimborne Area

Canadian Seaboard Oil Co. and associates have staked location for another wildcat in the Wimborne area of southern Alberta, 20 miles northeast of Olds and 60 miles north of the city of Calgary.

The location for 6-25 Wimborne is LSD 6, 25-34-27w4. Drilling contract has been given Cascade Drilling Co., Ltd. Canadian Seaboard will be operator of the test. The group backing this wildcat includes Honolulu, Merrill, and Banff Oil.

The well is 3 miles north-northwest of a dry hole at Baysel-Amerada 5-7 Mayton; it is 4¼ miles northwest of 7-9 Wimborne, a D3 Devonian oil discovery drilled 2 years ago by Seaboard-Banff.

MANITOBA

Completion Reported at North Virden Area Well

California Standard Co. reported completion of a well in Manitoba's North Virden-Roselea field in the southwestern part of the province. The well is in the Ralston sector of the province, 12 miles northwest of Souris railpoint and 20 miles southeast of the town of Virden.

The 13-23 Scallion, LSD 13, 23-11-26w1, is at completion depth of 2,098 ft. and is being completed in the Mississippian oil zone of Alberta.

Wildcat Location Staked North of Rossington-Westlock

Texaco Exploration Co. will drill a wildcat in the Shoal Creek region of north-central Alberta, 55 miles northwest of Edmonton and 42 miles southwest of the town of Athabasca. Location for the A-6-5 Roundup, LSD 6, 5-62-1w5, is 9 miles north of Rossington-Westlock Viking sand gas field and 4 miles south of Imperial 1 Dapp, a dry hole.

Successful Wildcats

ALBERTA

Okalta Canpet 7-9 Richdale, LSD 7, 9-30-12w4, TD 3,798 ft. Gaswell.

CALIFORNIA

Kings County: Middle Dome Corp. 38-19V Well, SE SW 19-23s-19e, IPP 30 BOPD, 33° gravity, perfs. 11,151-11,416, 11,482-11,886 and 11,916-12,220 ft., TD 13,076 ft. plugged back to 12,250 ft. (Deeper pool discovery in Kettleman Middle Dome field.)

Los Angeles County: Richfield Oil Corp. 1 Boyle Industrial, SW NE 35-1s-13w, IPP 170 BOPD, 25.7° gravity, 12/64-in. choke, perfs. 3,116-3,488 ft. TD 6,530 ft., TD 3,492 ft. (New field discovery in Boyle Heights area of Los Angeles.)

COLORADO

Larimer County: Fort Collins Producing Corp. 1 Martinez, SW SW SW 8-8n-68w. Swabbed 74 BO in 4 hours, Lyons discovery, new pay. TD 6,212 ft. Lyons.

Moffat County: Continental-Sinclair 3-A Unit, SW SE SE 8-3n-91w. IPF 134 BO 7 hours, ¼-in. choke, Weber oil discovery, new pay. TD 4,496 ft. Morgan.

Washington County: Maxey Drilling Co. 1 Spotts, C NW NE 1-2n-52w. IPP 70 BOPD, "J" sand discovery, new field. TD 4,541 ft. "D" sand.

Weld County: Halbert, Jennings and Simic, Don Rounds 1 Chapel, C NE NE 17-9n-56w. IPF 6 BOPH, ¼-in. choke, "D" sand oil discovery, "J" sand gas discovery, new field. TD 5,931 ft. "J" sand.

MONTANA

Hill County: The Texas Co. 1 DeMartin, C NE SW 34-34n-9e. IPP 1 BO, Sawtooth discovery, new pool. TD 3,432 ft. Sawtooth.

OKLAHOMA

Noble County: Rotary Development Co. 1 Roberts, NE NE SW 13-20n-2w. IPF 480 BOPD, Skinner sand 4,905-11 ft., 38°, ¼-in. choke. TD 5,512 ft. (Oil discovery.)

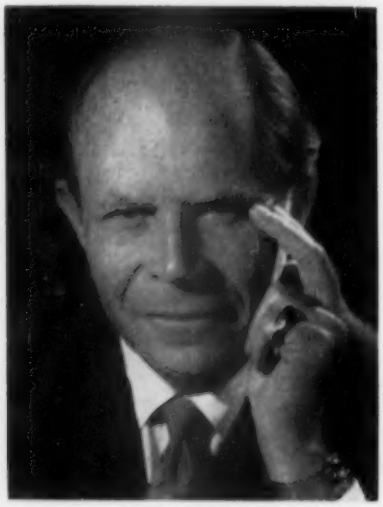
Stephens County: Carter Oil Co. 1 Smith, SE SE SE 5-1n-8w. IPF 28 BDPD, 619 M.c.f. of gas per day, lower Rowe sand 5,202-20 ft., 58.5°, 13/64-in. choke. TD 6,600 ft. (Gas-distillate discovery.)

(Continued on page 173)

PERSONALS

From roughneck to world-wide independent . . .

Feldman Bosses a Growing Firm



WANT a tough job? Join the D. D. Feldman Oil & Gas Co. and try keeping up with the boss.

It was trouble enough when Feldman activities were confined to this country. Now that the organization has spread abroad, it's a king-sized job.

The boss is David Daniel Feldman. In the past 26 years, he has built from scratch one of the country's most successful independent oil-producing concerns. He didn't do this standing still.

The company until recently had offices in Dallas (headquarters), New York, Houston, Los Angeles, Lafayette, La., and Midland, Tex. You usually could expect to find him at any one of these.

Now it's a little more difficult. He might be in London, Paris, Ankara, or Rome.

How he started . . . Feldman is a native Texan and a millionaire—but definitely not the loud, free-wheeling figure cartoonists love to picture as the typical rich Texan.

On the contrary he is somewhat shy. His name seldom appears in print.

Feldman got his start in the oil business in 1929, 4 years after graduating from Cornell University where he majored in engineering and economics. He decided before leaving college that he wanted to go into the oil-producing business.

He felt he needed capital and field experience. He went after both. He got the capital ($50,000 worth) by negotiating real estate purchases for The Texas Co. in Florida.

He then spent 2 years as a roustabout for Texaco (salary 75 cents an hour) and as a roughneck on a drilling rig for Gulf Oil Corp (salary $1.25 an hour). He picked up know-how in the East Texas field watching land men deal with farmers and learned all he could on buying and selling leases on expectation.

In 1929 when he was only 24, Feldman began looking around for the best possible property investment. He used the money from his work in Florida to buy two oil properties that year from a major oil company. These were in Powell and Lytton Springs fields in Central Texas.

In Powell, he reactivated old wells, tripled production, got back his purchase price in 3 months, and sold out 4 years later for four times the initial investment.

The Lytton Springs property is still producing oil for the company and so far has earned Feldman 40 times what he paid for it.

The depression struck in 1930, and many over-extended operators were forced to sell out cheap. Feldman weathered the bank closures because his firm wasn't operating on a shoestring, or on credit, or dependent on partners. He stood pat, refusing to sell his oil when prices dropped too low.

The big growth . . . He began buying again in 1932, acquiring leases and farmouts in Conroe field near Houston.

In 1935 Feldman bought the producing Tuleta property in Bee County, Texas, recouped his investment in 2 years, and later sold out at twice the original purchase price.

He struck his first major flush production in Jennings field in Louisiana in 1937.

In 1944, Feldman pulled off the outstanding deal of his career to date, acquiring the Rio Bravo holdings of the Southern Pacific Railroad Co. These included 115,000 acres in fee and producing properties in the Gulf Coast and North and West Texas. Seven discoveries have been brought in on the fee lands since the purchase, and highly successful water-flooding operations have been carried out on the properties where production had already been established.

His latest success was the completion of a major discovery in Brazoria County, Texas, in a joint drilling deal with the Lion Oil Division of Monsanto Chemical Co.

Work is his hobby . . . Feldman's consuming interest is the oil business. It's his hobby as well as his work.

He is, however, keenly interested in art and in encouraging and helping those with artistic talent. Feldman for several years donated money for art scholarships at several schools and as prizes in various art competitions.

The oil man recently bought 100 of the finest paintings by Texas artists to start the D. D. Feldman Contemporary Texas Art Collection. This collection now lines the corridors of the company's modern new headquarters suite in the Republic National Bank Building in Dallas.

G. L. Stewart, board chairman of Imperial Oil, Ltd., has retired after 39 years with the firm. Stewart served as chairman from 1947 to 1949, and was elected again in 1953. From 1949 to 1953 he was president. Other Imperial changes: **W. O. Twaits,** director and vice president, named executive vice president; and **J. A. Cogan,** assistant manufacturing manager, named a director.

T. G. Schad, former purchasing agent for Asiatic Petroleum Corp., has been named executive assistant to the materials department vice president. Schad, who has been with Asiatic since 1920, became purchasing agent in 1945.

HOLLOWAY

Dr. Fred A. L. Holloway, assistant general manager of Esso Standard Oil Co.'s East Coast division since September, has taken over as general manager of manufacturing on the East Coast. Holloway succeeds **Charles Leet,** recently elected a director of Creole Petroleum Corp. Before coming to Esso's Linden, N. J., headquarters, Holloway was superintendent of the Baton Rouge refinery.

Thomas S. Lennox has been moved up from assistant manager to manager of Socony Mobil Oil Co., Inc.'s Trenton, Mich., refinery. Lennox succeeds **Samuel G. Keller,** who has retired after 23 years with the firm.

PERSONALS

Gulf Coast Geologists Elect Layden

Robert L. Layden, center, San Antonio, will preside over the Gulf Coast Association of Geological Societies during 1956. Other officers, old and new, are, left to right: A. E. Blanton, Jackson, Miss., 1955 president; Felix H. Webster, Baton Rouge, 1955 secretary; Lloyd D. Traupe, Houston, 1955 vice president; and Michael W. Beckman, Shreveport, 1956 vice president. Not shown: Charles W. Holcomb, 1956 secretary.

L. E. Powell, area foreman for Continental Oil Co. at Palco, Kans., and **D. W. Matthews,** assistant district superintendent for the firm at Ardmore, Okla., have been named to supervise two new district production offices. Powell goes to Plainville, Kans., and Matthews to Oklahoma City. The new offices result from reorganization of Conoco's Kansas and Oklahoma production departments.

W. G. COPELAND

William G. Copeland, general superintendent of The Texas Co.'s Port Arthur works, has been promoted to operations division manager in New York. He succeeds **Howard S. McCray**, recently named manager of Texaco's purchasing department. **Henry Flynn,** former superintendent of manufacturing at Port Arthur, succeeds Copeland, and **H. E. Fouts** takes Flynn's post. Copeland joined the firm in 1927 as a chemist. He was superintendent at the Eagle Point Works, Westville, N. J., and at Sunburst, Mont., before going to Port Arthur.

E. D. Kelly, former director of the Federal Facilities Corp.'s office of synthetic rubber, has joined George Armistead & Co., Washington consultants, as administrative director.

Charles Barr has resigned as district exploration superintendent for Stanolind Oil & Gas Co. at Denver to become an independent. **Tom Costakis,** former district landman at Denver, replaces Barr.

J. B. Turner, assistant chief engineer of Sun Oil Co.'s crude-lines department, Beaumont, since 1949, has been moved up to chief engineer. Turner replaces **S. E. Ogle,** who will continue as a Sun vice president and director.

J. E. Downey has been promoted by Phillips Petroleum Co. to assistant division manager and division landman in the Calgary, Alta., office. Downey replaces **L. M. Spleth,** now division landman at Denver.

E. V. Hewitt, vice president of Pan American Production Co., Houston, has been elected a director. Hewitt also is vice president and manager of Pan American Gas Co.

Robert B. Bossler has been named professor of petroleum engineering at Texas A. & M. and will specialize in courses on evaluation and secondary recovery. Bossler has been serving as director of the Pennsylvania Grade Crude Oil Laboratories at Bradford. He formerly was chief engineer and vice president of Brundred Oil Corp., Oil City, Pa.

Aaron Griffin, manager of Texas Gas Transmission Corp.'s Owensboro district since 1953, has taken over the newly created post of assistant superintendent in Pipeline Division 2. Headquartered in Owensboro, the division extends northward from the Tennessee-Kentucky border. Griffin joined T.G.T. in 1949 as a soil conservationist.

Hal R. Adams has been promoted from division geophysicist to northwest division exploration manager for Sohio Petroleum Co. at Oklahoma City.

Victor C. Larsen, assistant manager of General Petroleum Corp.'s pipeline department since 1952, has been promoted to department manager.

George L. Bonar, assistant to the board chairman of The Texas Co. since 1954, has been named general manager of crude purchases and sales. Bonar joined Texaco in 1928, became assistant to the vice president in Houston in 1944, and transferred to New York as assistant to the executive vice president in 1950.

Randal O. Maass, manufacturing manager of Standard-Vacuum Petroleum Mij., Stanvac Indonesian refining subsidiary, has been named manager of the firm's supply, transportation, and

R. O. MAASS

W. C. CLARK

service division. In another change growing out of Stanvac's $80 million Indonesian expansion, **William C. Clark** has resigned as refining and oil movements superintendent of Esso Standard Oil Co.'s Baton Rouge refinery to join S.V.P.M. as refining manager. Maass went to Indonesia in 1951 as assistant to S.V.P.M.'s manufacturing manager, and moved up to manager 3 years later.

PERSONALS

C. H. Atchison, district manager for British American Oil Producing Co. at Midland, Tex., has been named manager of the firm's new exploration division there. The new division includes

C. H. ATCHISON

W. O. CALLAWAY

North and West Texas and Southeastern New Mexico. In another B.A. change, **William O. Callaway,** former district manager at Fort Worth, has been moved up to northwestern division exploration manager at Denver. He replaces **C. E. Riddle,** who resigned recently. **Hugh Looney,** former district geologist at Fort Worth, succeeds Callaway.

George R. Grim has been elected president of Manabi Exploration Co., Ecuadorian subsidiary of Pantepec Oil Co., C. A. Grim, former vice president and general manager, succeeds **Louis W. Stroms, Jr.,** and will continue directing company operations in Ecuador.

James H. Lewis, veteran California independent and former head of Sunset Oil Co., has been elected executive vice president and general manager of the Independent Refiners Association of California.

Dr. M. W. Kriegel and **L. W. Welch** have been named to head new sections in Carter Oil Co.'s Tulsa research laboratory. Kriegel, a member of the research staff since 1940, will direct a production-engineering section. Welch, former field production engineer and exploitation researcher for Carter, will head the production-research section.

Newell C. Loomis has been promoted by Gulf Oil Corp. from assistant manager to manager of products supply in the crude oil and products supply department. Loomis replaces **R. O. Jennings,** who has resigned. Succeeding Loomis is **James N. McGarvey,** former section head in products supply. Both men continue in Gulf's Pittsburgh offices.

Emil V. Hegyi, former assistant to the president of U. S. Freight Co., has been elected president and a director of Reiter-Foster Oil Corp., New York.

Ed Parkes, vice president and general manager and a director of United Gas Corp., Shreveport, has been named a director of the American Gas Association. Parkes succeeds the late M. A. Abernathy, former vice president of United Gas. Parkes also is a director and vice president of United Gas Pipe Line Co., transmission subsidiary.

L. W. Calahan has been promoted from division geologist to assistant production manager of The Texas Co.'s Louisiana division. **W. W. Moore, Jr.,** senior geologist in the Louisiana division since 1953, succeeds Calahan. Calahan joined Texaco in 1937 as a junior geologist and became division geologist in 1951.

Robert W. Chace, area manager for Gulf Oil Corp. at Salt Lake City, has been transferred to the Casper, Wyo., area.

John H. Beach, H. Victor Church, and **J. Ainslie Bell,** West Coast exploration men, have formed a new exploration partnership with headquarters in Los Angeles. Beach now is exploration manager for Oceanic Oil Co., and the new partners will continue working in some areas for Oceanic. Church has been chief geologist for Oceanic since 1951. Bell now manages drilling in France for Drilling & Exploration Co. He will return to this country in February to handle drilling and engineering for Beach-Church-Bell.

DEATHS

Dr. Ludger Mintrop, 75, geologist known for his seismic studies, died January 2 in Heidelberg, Germany. His work had aided the discovery of oil fields in the Gulf of Mexico.

Charles Ulrich Bay, 67, president of Bay Petroleum Corp., Denver, until its sale last spring to Tennessee Gas Transmission Co., died December 31 at New York City Medical Center. Bay was a former U. S. ambassador to Norway.

W. Henry Potterf, 52, Ardmore, Okla., independent operator, died recently in Tulsa.

T. W. Phillips, Jr., 81, president of T. W. Phillips Gas & Oil Co., Butler, Pa., died there January 2. Phillips for many years was active in Republican politics in Pennsylvania. He was a member of Congress for two terms.

James Evans Douglas, 54, Houston independent operator and drilling contractor, died there recently. A native of Memphis, Douglas spent 18 years with Standard Oil Co. (N. J.) in Mexico.

Gordon Silva, 46, and **Lloyd L. Cotton,** 38, Tulsa-based pilots for Gulf Oil Corp., were killed recently when their company plane crashed near Cambridge, Ohio, while enroute to Gulf's Pittsburgh headquarters.

M. T. (Ted) Wilson, 55, co-owner and field superintendent of Calliahn Rotary Co., Abilene, Tex., died there January 1. Wilson had worked in West Virginia oil fields before moving to Texas in 1917.

Charles H. Hoens, Sr., 59, who retired recently as supervisor of oil movement and storage at Esso Standard Oil Co.'s Bayway refinery, died January 3.

William N. Finnegan, 59, who retired in 1954 as public relations chairman for Humble Oil & Refining Co., died December 28 in Houston. Finnegan, who joined Humble in 1919 as a draftsman, was considered a pioneer in oil-industry press relations. He had been vice chairman of the Oil Industry Information Committee and in 1952 received an A.P.I. recognition certificate for his work in that field.

J. H. Steen, 60, crude buyer for The Texas Co.'s Houston division, died recently in Houston. He had worked for Texaco 35 years in the Gulf area.

William R. Campbell, of Vaughan, Zoch, Turnbull, & Campbell, Denver oil producers, died recently in Fort Collins, Colo. He was 39. Campbell was with Stanolind Oil & Gas Co. for 15 years before joining the Denver firm in 1954.

W. Edward Culbertson, veteran Cranberry, Pa., oil producer, died recently in Oil City, Pa. He was 79.

L. J. Hall, 52, president and a director of Condor Petroleum Co., Abilene, Tex., died there January 1. He was the brother of Ellis Hall, former Condor president who was killed in a 1953 plane crash.

James Otis Redinbaugh, 60, Tulsa equipment designer and manufacture, died January 2 in Tulsa.

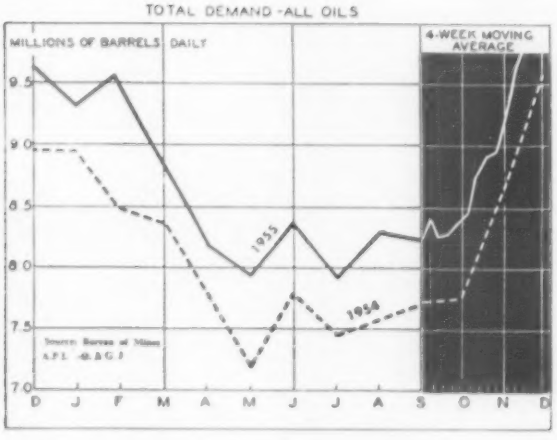
CURRENT STATISTICS — John C. Casper, Economics Editor

Latest Figures . . . Industry Trends

A QUICK LOOK AT THE HIGHLIGHTS

	LATEST WEEK	Change from WEEK AGO		Change from YEAR AGO	
Production	6,959,300	DOWN	9,400	UP	574,103
Crude stocks	260,936,000	UP	2,877,000	DOWN	4,455,000
Completions	640	DOWN	333	DOWN	244
Refinery runs	7,907,000	UP	69,000	UP	611,000
Gasoline stocks	164,859,000	UP	3,118,000	UP	7,631,000
Kerosine stocks	27,437,000	DOWN	1,341,000	DOWN	1,844,000
Distillate stocks	112,792,000	DOWN	5,162,000	UP	3,161,000
Residual stocks	39,872,000	UP	372,000	DOWN	11,489,000
Four-product stocks	344,960,000	DOWN	3,013,000	DOWN	2,541,000
Total imports	1,537,900	DOWN	20,900	UP	94,200

ALL CHARTS, BASED ON A.P.I. REPORTS, ARE FOR WEEK ENDED DECEMBER 23 SINCE THE A.P.I. REPORT FOR DECEMBER 30 WAS DELAYED BY END-OF-YEAR HOLIDAYS.



Distillate Prices Gain Both on Gulf Coast and in Mid-Continent

CONTINUING high demand for heating oils, under the influence of cold weather pushed distillate prices up in the Mid-Continent and on the Gulf Coast.

No. 2 fuel on the Group 3 market has moved up 0.75 cent a gallon since late in November. At that time the low of quotations for No. 2 for northern shipment was 8.25 cents. Prices strengthened during December at the rate of about 0.125 cent a week. By the end of the year, formal quotations were falling behind actual selling prices. The result was an increase of 0.25 cent by January 3.

The current quotation of 9.00 cents a gallon is the low of the market with some spot material selling for as much as 9.25 cents.

All of the major products are selling for more on the Group 3 market in the first week of 1956 than in the first week of 1955. The largest gains were at opposite ends of the price scale—gasoline and residual. In the first week of 1954, Group 3 regular gasoline was selling on the spot market for as little as 10.25 cents with premium bringing only 11.25 cents. Low quotations for regular are now up to 11.00 cents with premium selling for 12.50. Note that the spread between the two grades has increased by 0.50 cent a gallon.

Tanker rates hurt Gulf Coast . . . Gulf Coast distillate prices dropped sharply in the spring of 1955—from 9.0 cents a gallon for No. 2 fuel as late as the middle of March to 8.0 cents on June 1. Quotations moved back up to 8.5 cents in August, but increased tanker rates in the last quarter of the year prevented normal winter price increases. Kerosine and distillate prices were raised 0.25 cent a gallon at the very end of December, but this gain was not enough to bring prices up to year-earlier levels.

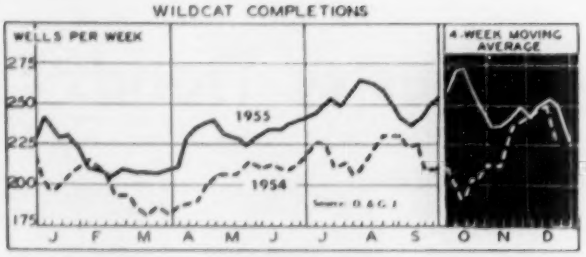
Decreased consumption for kerosine in the upper East Coast has put more pressure on this product than on No. 2 distillate. The current quotation for barge delivery of kerosine in New York Harbor is 0.15 cent a gallon less than a year ago. The Gulf Coast price is down 0.5 cent.

Residual highest in 7 years . . . Group 3 quotations for residual fuel moved up $0.05 a barrel last week, but some material is selling above the current posting. The lowest posting for low-sulfur material is $2.05 a barrel compared with about $1.60 at this time last year. Most of current sales are at prices at least $0.10 above the new quotation.

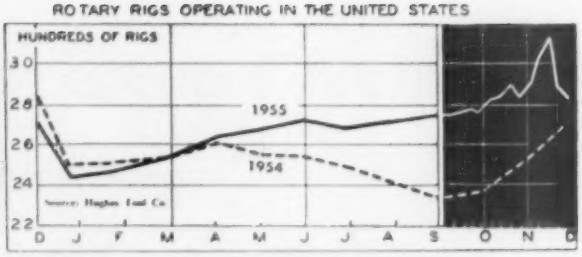
Residual prices in all major marketing areas east of the Rockies are higher than at any other time since 1948. High-sulfur fuel reached the following peaks in 1948: Group 3, $2.50; Gulf Coast, $2.56; and New York barge, $3.03. These peaks of 1948 were followed by sharp drops in 1949.

Changes on Markets page . . . On the expanded Markets page last week, price changes were indicated by printing the product and price in boldface type. To make these changes more conspicuous, price changes will be indicated by a star before the product name.

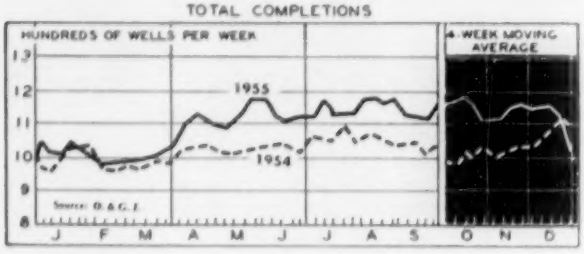
WILDCAT COMPLETIONS



ROTARY RIGS OPERATING IN THE UNITED STATES



TOTAL COMPLETIONS



ACTIVE ROTARY RIGS*

Area—	1-2-56	Change from 12-26-55	Change from 1-3-55
Gulf Coast	654	—24	82
N. and W. Texas-New Mexico	1,005	1	206
Arkansas-N. Louisiana-E. Texas	170	—16	—28
Oklahoma	330	23	78
Kansas-S. Nebraska	167	—11	— 2
Illinois-Eastern	109	—21	—14
Rocky Mountain	254	— 4	22
Pacific Coast	140	— 3	—11
Total United States	2,829	—55	333
Western Canada	194	— 6	7

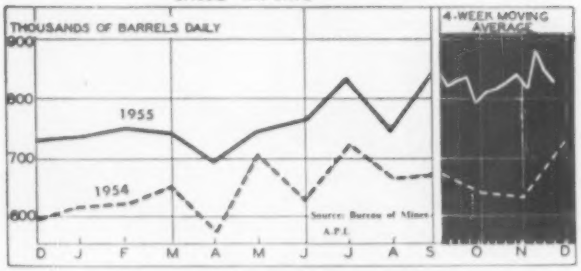
*Hughes Tool Co.

WEEKLY WELL COMPLETIONS . . . WEEK ENDED DECEMBER 31, 1955

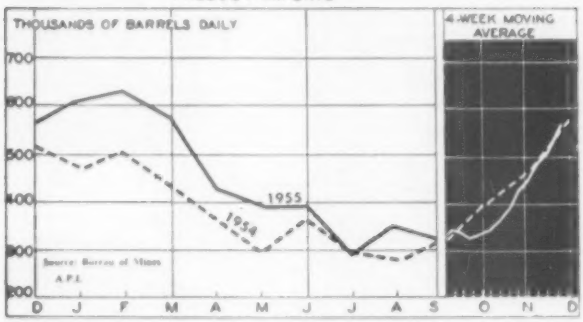
	Total of all wells — Comp.	Oil	Gas	Dry	Footage	Cum. 1955	Cum. 1954	Wildcat completions and discoveries — Oil	Dist.	Gas	Dry	Total	Cumulative total, 1955 — Oil	Dist.	Gas	Dry	Total
Ala.-Ga.-Fla.	0	0	0	0	0	73	94	0	0	0	0	0	1	0	0	70	71
Arkansas	6	4	0	2	31,403	804	665	0	0	0	0	0	35	1	4	170	210
California	38	22	0	16	189,672	2,464	2,353	2	0	0	11	13	45	0	13	471	529
Colorado	58	10	11	37	278,721	1,537	1,358	5	0	0	25	30	55	0	24	743	822
Illinois	50	22	1	27	114,116	3,892	3,135	2	0	0	8	10	74	0	6	555	635
Indiana	7	3	0	4	11,400	706	887	0	0	0	1	1	11	0	0	250	261
Kansas	54	24	4	26	192,270	4,958	4,722	1	0	0	12	13	134	1	34	849	1,018
Kentucky	24	12	1	11	29,425	1,592	1,188	0	0	1	3	4	53	0	12	334	399
Louisiana	40	28	1	11	269,825	4,019	3,611	1	0	0	4	5	113	82	33	467	695
North	16	16	0	0	24,242	2,071	2,010	0	0	0	0	0	23	11	8	200	242
South	24	12	1	11	245,583	1,948	1,601	1	0	0	4	5	90	71	25	267	453
Michigan	7	1	3	3	21,639	512	567	0	0	0	2	2	12	0	2	198	212
Mississippi	0	0	0	0	0	448	441	0	0	0	0	0	14	0	0	168	182
Montana	13	6	0	7	49,849	412	343	1	0	0	7	8	14	0	2	156	172
Nebraska	21	9	0	12	113,711	905	472	0	0	0	8	8	45	0	1	380	426
New Mexico	12	0	11	1	35,742	1,696	1,126	0	0	0	1	1	40	2	10	121	173
Northwest	12	0	11	1	35,742	620	387	0	0	0	1	1	8	1	10	44	63
Southeast	0	0	0	0	0	1,076	739	0	0	0	0	0	32	1	0	77	110
North Dakota	3	2	0	1	19,869	254	312	0	0	0	1	1	7	0	0	62	69
Ohio	21	13	0	*8	56,288	1,224	1,182	0	0	0	0	0	4	0	8	16	28
Oklahoma	78	45	7	26	271,700	8,411	8,786	1	0	2	4	7	135	19	31	647	832
Pennsylvania-New York	4	0	4	0	13,620	1,095	1,766	0	0	0	0	0	0	0	9	13	22
Texas	152	118	5	29	603,696	19,981	18,865	2	0	0	3	5	773	110	132	4,109	5,124
Southwest (1 & 4)	12	8	2	2	38,400	3,095	2,630	0	0	0	2	2	116	36	40	790	982
Gulf Coast (2 & 3)	21	11	1	9	147,000	2,506	2,655	0	0	0	0	0	94	61	43	663	861
East (5 & 6)	1	1	0	0	4,963	984	1,053	1	0	0	0	1	25	5	11	326	367
North Central (7-B & 9)	81	65	0	16	243,001	7,433	7,138	0	0	0	0	0	364	0	17	1,629	2,010
West (7-C & 8)	21	19	0	2	113,631	4,908	4,431	0	0	0	1	1	162	1	12	665	840
Panhandle (10)	16	14	2	0	56,701	1,055	958	1	0	0	0	1	12	7	9	37	65
Utah	12	1	2	9	58,899	94	91	0	0	2	7	9	6	0	8	59	73
West Virginia	3	0	3	0	9,476	640	614	0	0	0	0	0	0	0	11	19	30
Wyoming	36	4	12	20	150,629	917	1,221	0	0	2	8	10	26	0	10	227	263
Miscellaneous (Ore.)	1	0	0	1	4,880	60	131	0	0	0	1	1	4	0	3	49	56
Total United States	648	324	65	251	2,526,830	†56,694	†53,930	15	0	7	106	128	1,601	215	353	10,133†	12,302
Total previous week	973	514	90	369	4,191,238			29	3	8	177	217	1,593	215	343	10,005	12,156
Total January 1, 1955	884	472	66	346	3,841,392			27	0	10	209	246					
Western Canada	40	20	4	16	198,614												

Service wells included: *1. †Revised.

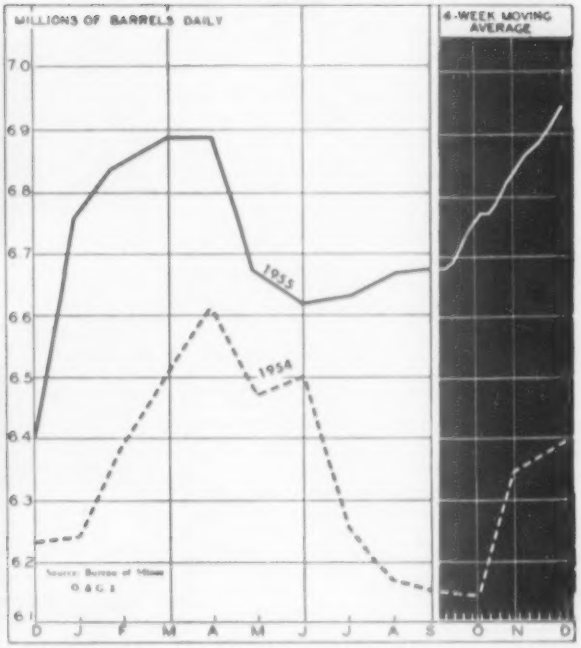
CRUDE IMPORTS



PRODUCT IMPORTS



CRUDE-OIL PRODUCTION

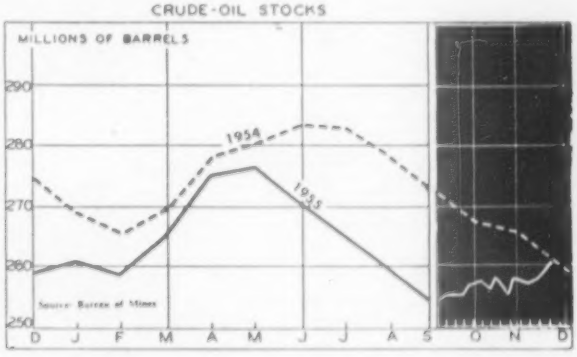


DAILY AVERAGE PRODUCTION FOR WEEK

	December 31			Dec. 24
	Crude oil	Lease condensate	Total	total
Alabama	4,200		4,200	4,400
Arkansas	73,450	500	73,950	74,300
California	978,600		978,600	978,800
Colorado	158,700		158,700	157,100
Eastern	50,000		50,000	52,100
Florida	1,350		1,350	1,350
Illinois	232,900		232,900	234,000
Indiana	30,000		30,000	30,400
Kansas	336,000		336,000	338,800
Kentucky	40,300		40,300	40,300
Louisiana	712,600	58,300	770,900	771,350
North	114,600	2,300	116,900	117,350
South	598,000	56,000	654,000	654,000
Michigan	30,800		30,800	30,400
Mississippi	107,300	5,050	112,350	112,350
Montana	38,700		38,700	39,400
Nebraska	28,100		28,100	28,400
New Mexico	223,800	4,150	227,950	228,050
North Dakota	32,300		32,300	33,200
Oklahoma	596,400		596,400	595,000
Texas	2,887,000	53,250	2,940,250	2,940,250
Dist. 1	56,000	600	56,600	56,600
Dist. 2	154,000	8,100	162,100	162,100
Dist. 2	414,000	25,200	439,200	439,200
Dist. 4	241,000	5,400	246,400	246,400
Dist. 5	49,000	525	49,525	49,525
Dist. 6	126,500	5,800	132,300	132,300
East Texas field	223,500		223,500	223,500
Dist. 7-B	150,000	50	150,050	150,050
Dist. 7-C	175,000	4,800	179,800	179,800
Dist. 8	992,000	2,000	994,000	994,000
Dist. 9	216,000	575	216,575	216,575
Dist. 10	90,000	200	90,200	90,200
Utah	4,750		4,750	4,750
Wyoming	270,600		270,600	270,600
Others	‡200		‡200	200
Total U. S.	6,838,050	121,250	6,959,300	6,968,700
Change from previous week, down			9,400	
Canada	†		†	†406,325
Total U. S. production January 1-October 31				§2,472,500,000 bbl.
Same period last year (crude plus cond.)				*2,316,323,265 bbl.

*Includes 35,911,500 bbl. condensate. †Week ended previous Monday. ‡Includes Nevada 200. §Revised.

CRUDE-OIL STOCKS



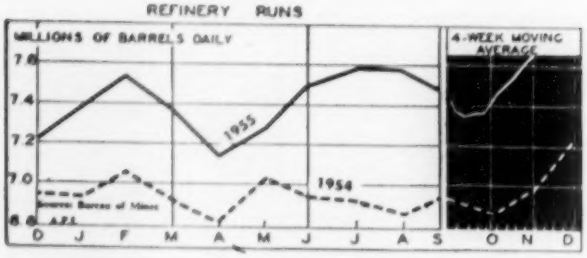
CRUDE-OIL STOCKS BY STATES OF ORIGIN*

(Thousands of barrels)

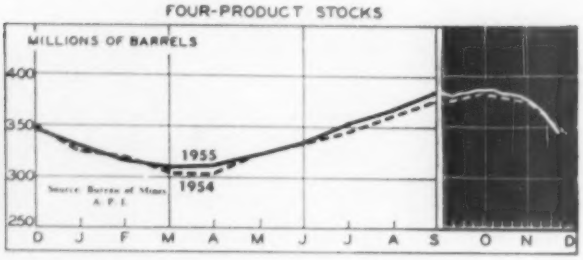
	12-24-55	12-17-55	12-25-54
Pennsylvania Grade	2,956	3,014	3,022
Other Appalachian	2,100	2,269	1,908
Illinois, Indiana, Michigan	9,219	9,143	12,139
Nebraska, North Dakota	1,978	2,004	1,820
Kansas	7,870	8,013	8,643
Oklahoma	22,126	21,261	25,617
Arkansas	2,407	2,380	3,025
Louisiana	16,176	16,576	15,527
North	2,563	2,440	2,478
South	13,613	14,136	13,049
Mississippi	2,814	2,612	2,687
New Mexico	7,634	7,537	8,662
Texas	123,903	122,484	119,775
East Texas proper	9,329	9,254	10,173
West Texas	58,486	58,152	54,360
Texas Gulf	24,527	23,756	23,059
Other Texas	31,561	31,322	32,183
Wyoming	15,231	15,249	14,416
Other Rocky Mountain	6,359	6,092	5,254
California	28,113	27,393	31,707
Total	260,936	258,059	265,391

*Bureau of Mines. Includes 2,316,000 bbl. in California.

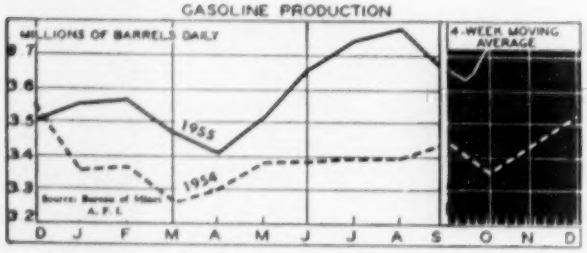
REFINERY RUNS



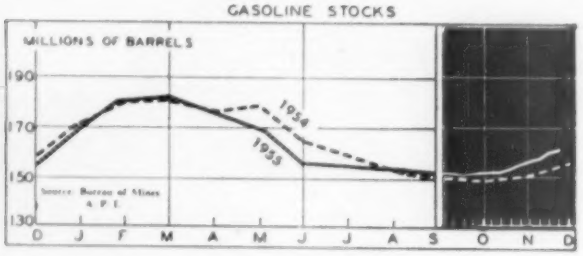
FOUR-PRODUCT STOCKS



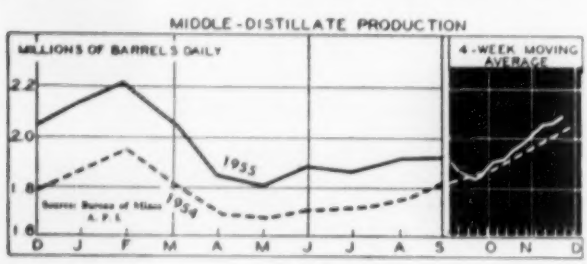
GASOLINE PRODUCTION



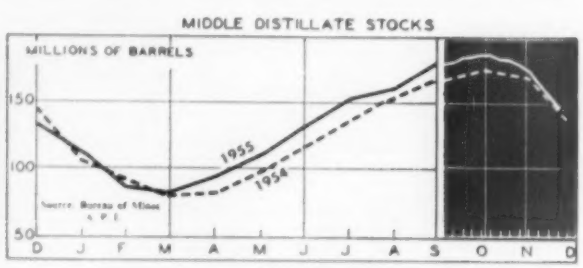
GASOLINE STOCKS



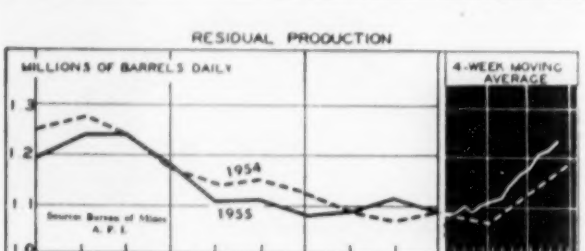
MIDDLE-DISTILLATE PRODUCTION



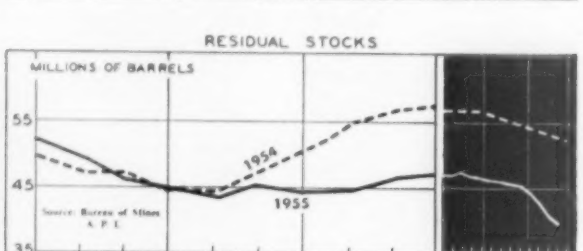
MIDDLE DISTILLATE STOCKS



RESIDUAL PRODUCTION



RESIDUAL STOCKS



A.P.I. REFINERY REPORT, DECEMBER 30

(Thousands of barrels)

District—	Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.	Stocks† Gaso.‡	Kero.	Dist.	Resid.	Bureau of Mines, December 1954 Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.
East Coast	1,095	469.0	20.4	277.0	276.3	35,724	11,323	41,367	11,497	1,048	426.8	34.3	281.0	249.0
Appalachian:														
District 1	108	44.9	8.0	25.3	8.9	4,634	605	2,205	513	98	40.9	6.4	20.5	9.2
District 2	106	54.6	6.3	19.6	16.7	2,356	439	847	302	75	36.4	6.6	13.2	9.5
Ind., Ill., Ky.	1,514	764.2	67.1	344.6	239.0	34,179	6,375	19,296	3,778	1,341	716.6	78.7	278.2	186.7
Okla., Kans., Mo.	761	435.6	20.9	197.7	35.0	17,614	1,452	11,685	1,335	645	361.7	20.6	167.0	44.3
Inland Texas	279	210.7	7.9	52.7	30.8	5,945	449	2,193	1,320	239	171.5	11.9	46.1	18.3
Texas Gulf Coast	1,943	921.6	145.8	527.0	259.7	22,347	2,904	13,527	6,675	1,797	835.3	139.6	468.0	226.4
La. Gulf Coast	711	339.1	63.7	173.1	57.6	9,966	2,560	5,961	1,431	606	307.4	61.8	159.9	38.9
N. La. and Ark.	93	37.0	8.0	22.1	7.3	4,271	654	2,199	67	88	35.8	9.1	20.5	7.8
Rocky Mountain:														
New Mexico	20	10.4		2.9	2.7	246	6	55	30	20	11.6	0.7	3.3	3.0
Other Rocky Mtn.	262	124.3	2.9	64.6	38.0	5,704	285	2,573	715	248	123.6	5.1	59.6	42.3
California	1,015	481.4	2.6	180.1	366.0	21,873	385	10,884	12,209	1,033	448.4	5.7	151.0	351.9
Dec. 30, 1955	7,907	3,892.8	353.6	1,886.7	1,338.0	164,859	27,437	112,792	39,872	7,238	3,515.4	380.5	1,668.3	1,187.3
Dec. 23, 1955	7,838	3,866.2	399.4	1,763.6	1,286.4	161,741	28,778	117,954	39,500					
Dec. 31, 1954	7,296	3,617.1	372.3	1,692.3	1,187.3	157,228	29,281	109,631	51,361					

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipelines.

Crude-oil and refinery prices at representative U. S. and foreign points

REFINED-PRODUCT PRICES

Following quotations are for refinery products in cents per gallon moving in interstate shipments on Wednesday each week unless otherwise noted. Crude-oil prices are per barrel at the wells unless otherwise listed.

GASOLINE*

Mid-Continent (Group 3):	
Regular (86 octane)	11.00-11.25
Premium (94 octane)	12.50-12.75
Gulf Coast (Cargoes for coastwise or export movement):	
Regular (90 octane)	11.00-11.25
Premium (97 octane)	13.00-13.25
New York (barges):	
Regular (89 octane)	12.25
Premium (96 octane)	14.50
California—Los Angeles (rack):	
Regular (84 octane)	13.10-13.15
Premium (93 octane)	14.10-15.10
Caribbean area (cargoes):	
Regular (87 octane)	10.50
Premium (93 octane)	11.50

*Quotations are for octanes shown. Prices usually vary with octane ratings within the regular, premium, and aviation grades.

NATURAL GASOLINE*

Group 3:	
Grade 26-70	6.00
Breckenridge:	
Grade 26-70	5.50

*If 26-70 natural is considered as 100 per cent, prices for lower-vapor-pressure grades increase 2.5 per cent for each unit drop in Reid vapor pressure down to and including 16-lb. Prices for grades below 16-lb. may vary slightly by areas or plants.

KEROSINE AND DISTILLATE

Mid-Continent (Group 3):	
★ Kerosine 42-44	10.00-10.25
★ Diesel oil (58 d.i. and above)	9.675-9.875
★ Distillate No. 1	9.675-9.875
★ Distillate No. 2	9.00-9.25
Gulf Coast (cargoes):	
★ Kerosine 41-43	9.00-9.25
★ Distillate No. 2	8.75-9.00
New York Harbor (barges):	
Kerosine 41-43	10.55
Distillate No. 2	10.05
Diesel fuel, 48-52 d.i.	10.35
Caribbean area (cargoes):	
★ Distillate No. 2	8.75

WAX (I.B.)

Oklahoma (Group 3):	
132-135 A.m.p. (semi-refined) in tank cars	6.50
New York (export):	
★ 126-130 crude scale (solid in bags or barrels)	7.10

★ Denotes change from previous week.

RESIDUAL FUEL (BBL.)

Mid-Continent (Group 3):	
★ Residual fuel (max. 1% S)	$2.05-2.15
Gulf Coast (cargoes):	
Bunker C fuel	$2.10
New York Harbor (barges):	
Bunker C fuel	$2.65
Caribbean (cargoes):	
Bunker C at Aruba, N.W.I.	$2.10
California (rack):	
Bunker C fuel, Los Angeles	$2.00

LUBRICATING OILS

Mid-Continent (Group 3):	
150-160 bright stock, solvent refined 0-10 p.p., 95 v.i.	23
200 vis. neutral oil, solvent refined, 0-10 p.p., 95 v.i.	19.75
Pennsylvania Grade:	
145-155 vis. at 210, bright stock, 8 color, 25 p.i.	22-23
200 vis. neutral (180 at 100°), 25 p.i.	20

CRUDE-OIL PRICES

GRAVITY SCHEDULE

	Signal Hill, Calif.	Mid-Cont.*	Gulf Coast Tex.†	West Tex.‡ N.M. (sour)	Wyo.
14-14.9	$1.97				
15-15.9	2.03				
16-16.9	2.09				
17-17.9	2.15				
18-18.9	2.21				
19-19.9	2.27				
20-20.9	2.33	$2.50		$2.37	
21-21.9	2.39	2.52		2.39	
22-22.9	2.45	2.54		2.41	
23-23.9	2.51	2.56		2.43	
24-24.9	2.57	2.58	$2.91	2.45	
25-25.9	2.63	2.60	2.93	2.47	
26-26.9	2.69	2.62	2.95	2.49	
27-27.9	2.76	2.64	2.97	2.51	
28-28.9	2.83	2.66	2.99	2.53	
29-29.9	2.91	2.68	3.01	2.55	
30-30.9	2.97	2.70	3.03	2.57	
31-31.9	3.04	2.72	3.05	2.59	$2.46
32-32.9	3.12	2.74	3.07	2.61	2.48
33-33.9		2.76	3.09	2.63	2.50
34-34.9		2.78	3.11	2.65	2.52
35-35.9		2.80	3.13	2.67	2.54
36-36.9		2.82	3.15	2.69	2.56
37-37.9		2.84	3.17	2.71	2.58
38-38.9		2.86	3.19	2.73	2.60
39-39.9		2.88	3.21	2.75	2.62
40 and up		2.90	3.23	2.77	2.64

*Includes Oklahoma, Kansas, North Dakota, West Texas (sweet), North Central Texas, North Louisiana, Arkansas, and Wyoming (sweet). †Low-cold-test Gulf Coast. ‡Sour.

Effective dates: California, October 17, 1955; east of California, June 15, 1953; Pennsylvania Grade, December 1, 1955.

FLAT PRICES

Louisiana:	
Cotton Valley (distillate)	$3.00
Cotton Valley (Holloway crude)	2.95
Texas:	
East Texas	2.90
Chapel Hill	2.83
Conroe	3.13
Van	2.73
Pennsylvania Grade:	
Bradford	†3.85
Middle District	†3.72
Southwest Pennsylvania	†3.43
West Virginia	†3.31
Buckeye Grade	†3.25
Zanesville Grade	†2.92

†Effective December 1, 1955.

Illinois Basin	3.00
Canada:	
Leduc-Woodbend (flat prices D-2, D-3)	2.60
Redwater (Alta.) D-3	2.49
Smiley-Viking (Sask.)	2.26
Fosterton (Sask.)	1.29
Pembina	2.52

FOREIGN

Venezuela:	
Cumareho, 48°-48.9°, Tucupido	*$3.40
San Joaquin, 41°-41.9°, Puerto La Cruz	*3.04
Oficina, 35°-35.9°, Puerto La Cruz	*2.80
Tia Juana medium, 26.5°-26.9°, Amuay	‡2.30
Quiriquire, 16.5°-16.9°, Caripito	‡2.21
Lagunillas heavy, flat, Amuay or Las Piedras§	2.05
Bachaquero, 16.5°-16.9°, Amuay or Las Piedras§	‡1.90

*Plus or minus 2 cents per barrel for each degree gravity change. †Plus or minus 2.5 cents per barrel for each half-degree gravity change. ‡Plus or minus 3.5 cents per barrel for each half-degree gravity change. §Also available at La Salina at 3.0 cents per barrel less.

Middle East, Persian Gulf (cargoes, f.o.b. lifting port):	
Arabian, 36.0°-36.9°, Ras Tanura	1.97
Iranian, 34.0°-34.9°, Bandar Mashur	1.91
Iranian, 34.0°-34.9°, Abadan	1.86
Iraq, 36.0°-36.9°, Fao	1.92
Kuwait, 31.0°-31.9°, Mina-al-Ahmadi	1.72
Qatar, 39.0°-39.9°, Umm Said	2.06
Middle East, E. Mediterranean:	
Arabian, 36.0°-36.9°, Sidon	2.39
Iraq, 36.0°-36.9°, Tripoli, Banias	2.39
Far East (cargoes, f.o.b. Lutong, Sarawak):	
Seria Light, 37°-38°	2.60

TANKER RATES (PER LONG TON)

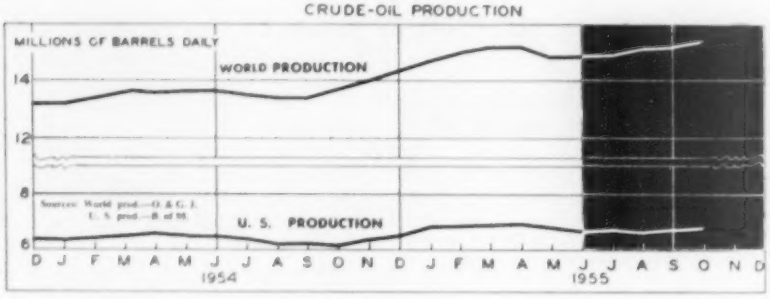
Gulf-New York, clean (USMC+135%)	$6.70
Gulf-New York, dirty (USMC+15%)	3.28
NWI—U.S.N.H., dirty (USMC+10%)	2.97
Persian Gulf—U.K. (Scale+90%) (90s. 11d.)	12.74

CRUDE PRODUCTION

(Thousands of barrels daily)

Month—	U.S.	World
October 1955	6,831	15,459
September 1955	6,731	15,168
August 1955	6,665	15,065
February 1955	6,835	14,943
October 1954	6,135	13,687

CRUDE-OIL PRODUCTION

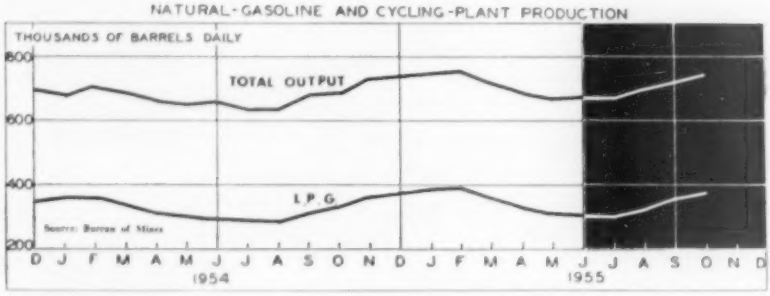


PRODUCTION OF NATURAL-GASOLINE AND CYCLING PLANTS

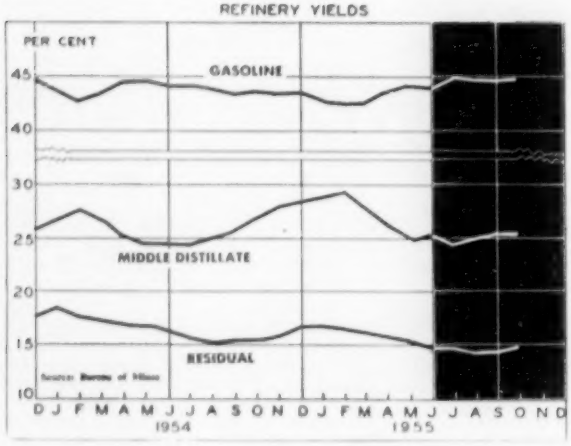
(Thousands of barrels daily

Month—	L.P.G.	Total
October 1955	381	747
September 1955	358	727
August 1955	328	698
February 1955	390	751
October 1954	332	692

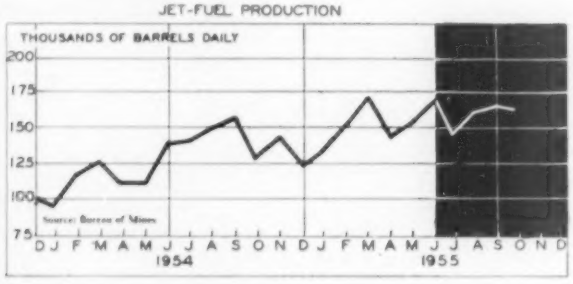
NATURAL-GASOLINE AND CYCLING-PLANT PRODUCTION



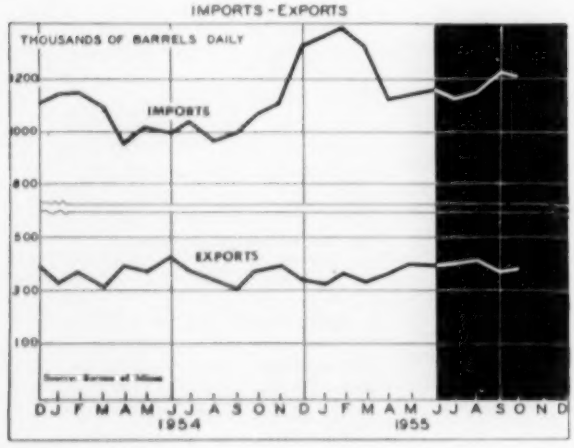
REFINERY YIELDS



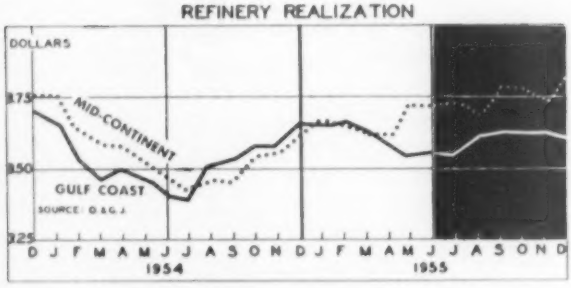
JET-FUEL PRODUCTION



IMPORTS-EXPORTS



REFINERY REALIZATION



REFINERY REALIZATION

	Dec.* 1955	Nov.* 1955	Oct. 1955	Dec. 1954
Mid-Continent	$3.83	$3.76	$3.79	$3.62
Gulf Coast	3.62	3.63	3.64	3.65

*Preliminary.

Refinery realization is based on yields of major products and average spot prices of regular gasoline, kerosine, No. 2 fuel oil, and residual as published in The Oil and Gas Journal.

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100,000 FT. 8⅝ lap weld, A-1 second-hand, 28-lb., plain-end and threaded pipe. Dick Griffin, Box 2373, Tulsa. Phone HIckory 6-0848.

FOR SALE: Used R. L. Cardwell Drilling-in Unit. Splendid condition with all accessories and large Doghouse. Located near Wichita. Phone or write John Richard, McClelland Hotel, Wichita, Kansas; or write Box 361, Topeka, Kansas.

FOR SALE—Two Walker-Neer Model C-34 Spudders, Trailer mounted. Waukesha 145GKU Engines complete with all drilling in tools, doghouses, light plants. 7500 ft. ¾" drill lines, 7,000 ft. ⅝" sand line. Inventory on request. Box J-284, The Oil and Gas Journal, Tulsa, Oklahoma.

8,089' NEW 4½" OD 16.60# Grade D External Upset, Internal Flush, Range 2—Youngstown Seamless Drill Pipe prepared for Hughes Seal Grip Joints with Colona Protectors. F.O.B. Great Bend and Chase, Kansas—$195.20 cwt. Buckeye Supply Co., 211 No. Broadway, Wichita, Kansas.

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PHILLIPS REFINERY
POCATELLO, IDAHO

HOT OIL PUMPS
Worth. 12" KUF Diesel drive.
Nat. Tr. 4x12 HDOEP Duplex.
Worth. 9x5x10 Duplex.

TRANSFER PUMPS
Duplex from 4x3x4 to 10x7x12.

FURNACE TUBES
4-6% Chrome ½ New Cost

TOWERS—COLUMNS
4'x59' 160 PSI 23 trays.
2'x47' 375 PSI 20 trays.
3'x49' 425 PSI 28 trays.
7'x54' 150 PSI 20 trays.
7'6"x41' 160 PSI Reactor.

FURNACES
Crude Oil 8 Million BTU
Light Oil 10 Million BTU

HEAT EXCHANGERS
94 to 550 sq. ft. Steel Tubes.
140 to 440 sq. ft. Adm. Tubes.

COMPRESSORS
1406 SCFM Gas Driven 250 PSI.
211 CFM Motor Drive 100 PSI.

ETHYL BLENDING PLANT
4200 gal. Tank, Scale & Building.

STORAGE TANKS
500 to 20,000 bbl. All Welded.

BOILERS
153 HP 160 PSI Water Tube (3).
250 HP 150 PSI Stirling.

WRITE FOR COMPLETE INVENTORY
AT OTHER LOCATIONS

25—Adm. Tube Cooling Section.
16—Tulsa Condensers.
2—100 HP 300 PSI Oil Field Boilers.
3—7'x24' Separators, 150 PSI.
13—Hor. Tanks 5,000 to 12,000 gal.
3—Steel Bldgs. 35'x190' & 25'x90'.

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FOR SALE EQUIPMENT

FOR SALE: 86' Oilwell Mast, with 4½ Substructure. Telephone: CE 2-6318, Oklahoma City, Okla.

FOR SALE—Near Ponca City, Oklahoma 16,000' 8⅝" OD 28# used line pipe suitable for casing or line pipe. Cities Service Pipe Line Company, Patridge, Bartlesville, Oklahoma.

FAILING 1500 heavy duty drill with 4½ x 5 pump, automatic pulldown, and mounted on Ford truck. Write P. O. Box 819, Longmont, Colo. Phone 1333.

FOR SALE—3 R. L. Cardwell Double Drum Spudders, each with a 4-legged mast and sub-structure. All in excellent condition. Priced to sell. Box 871, Seminole, Okla.

NEED A PIPE LINE

Have 800 Miles 8" Line Pipe we are taking up through Illinois, Indiana, and Ohio. Will furnish pipe, go in on a deal, or finance.

We are open for any kind of deal.

REDNEB PIPE CO.
P. O. Box 1798 Shreveport, La.
Phone 4-7767—68

FOR SALE EQUIPMENT

FOR SALE: 3400' of 3½" drill pipe, new sleeves, extra good. Telephone: CE 2-6318, Okla. City.

CORE DRILLS, SPUDDERS, ROTARIES. New and used equipment. Everything in supplies. Fishing tools rented. Pressey & Son, Pueblo, Colo.

Gaso Duplex 4½" x 6" Power Pumps with Chrysler C-36 Engines, skid mounted, immediate delivery. Also Byron Jackson, Carter Centrifugal Units, Westinghouse 20-25-50 KW Generating Units.

H. H. COFFIELD
Attn.: W. H. ORR
Phones: 132—Rockdale, Texas
AT-3427—Houston, Texas

FOR SALE: ONE NEW 3 Unit Westinghouse Metal Clad Indoor Lift Type Switch Gear, 6900 Volt, 100 Amp., Housing Code A, with one Breaker Oil Circuit Style #18Y9308, Type B-20-B, 600 Amp., 15,000 Volt, 3 Pole, Complete with Current and Potential Transformers, Necessary AC and DC Ammeters, and AC Voltmeters, Powerfactor Meters, Wattmeters, Temperature Indicators, Type CA Differential Relays, Type CO Induction Overcurrent Relays, Type WL Auxiliary Relay, Type SRA Voltage Regulator. CONTACT: L. F. Mayfield, Room 534, Adams Building, Phillips Petroleum Company, Bartlesville, Oklahoma.

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6—17,500 bbl. ea. CBI pontoon floating roofs; 4—80,000 bbl. cone roofs; 1—same breather roof, 10—55,000 bbl. cone roofs will cut down matchmark or reerect on customers grade. Wire, phone or write. DI 3-6141.

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FORMER PURE OIL COMPANY REFINERY, CHARLESTON (CABIN CREEK) W. VIRGINIA
6,000 Bbl. Topping—3,000 Bbl. Thermal Cracking, 100 Bbl. Catalytic Polymerazation—Lube Oil and Paraffin Wax Plant, Rerun Unit, 8500 Gal. Ethyl Plant, Boiler Plant, Tank Farm, Instruments—Complete Refinery Pipe, Valves, Fittings, etc.—Visit the plant—salesmen on premises.

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FORMER LACY REFINERY,

BIG SANDY, TEXAS

COMPLETE POLY UNIT, BUILT 1950

1—Wyatt 30" x 70' Stabilizer 160# 30 tray
3—Absorbers, 14" x 40', 20" x 50', 160#
2—Wash Towers, 18" x 23', 150#
1—Reactor, 24" x 28', 550#
1—Depropanizer, 20" x 35', 450#
1—Debutanizer, 12" x 26', 120#
3—Brinkman vertical tube furnaces 2, 1¼ mil. BTU/hr.
20—Brown fintube exchangers, 600# 140 sq. ft. 4-6 chrome.
20—Brown fintube exchangers, 600# 11, 21, 77, 101, 140 sq. ft.
3—Adm. heat exchangers 424, 346, 176 sq. ft.
3—Perco reactors 4300 gal., 8' x 13', 347 stls. st. 120#, 1000° F.
1—8' x 90' tower, 40 tray, 135# WP
1—7' x 30' Propane tank, 250# WP
1—10' x 50' Crude tower, 18 trays
1—6' x 24' Vacuum tower, 150#
1—2' x 50' tower, 24 trays
3—Welded tanks, 10' x 40', 10' x 30', 8' x 20'
3—St. excha., 2000, 1500, 480 sq. ft.
9—Oilfield boilers, 125 hp., 275#
1—Ethyl lead plant
3—Penn. comp. 8 x 11 x 9, 12 x 11½ x 13, 10 x 6 x 11
2—Convection furnaces, 4-6 ch tubing
1—Vapor phase cracking furnace
30—Welded storage tanks, 5000, 2000, 1000, 500 Bbl.
1—Waukesha anti-knock machine
8—Hi-vol pumps, 10 x 7 x 18, 10 x 6 x 12, 6 x 4 x 12, 6 x 3 x 8
20—Duplex piston pumps, all sizes
1—10' x 30' asphalt still
6—Steel Bldgs., 20 x 150, 12 x 20, 20 x 40, 20 x 20.
3—Pritchard cooling towers, Adm. Bentube exchanges
1—BS&B Oil & gas separator, 10.7 mcf, 3500 Bbl./day.

COMPRESSOR STATION—BALT., MD.

3—600 hp IR KVG Gas Comp.
1—MWK 2400 sq. ft. adm. exch. 150#

FINAL LIQUIDATION.
LEVELLAND, TEX.

6' x 58' ch lined tower, 50#, 21 tray
8' x 40' ch lined vessel, 90#
30,000 ft. 4, 6 in. pipe
5,000 ft. 2", 4", 4-6 ch pipe

EQUIPMENT ELSEWHERE

COLUMNS

7' x 115' 50 tray
8' x 75' 25 tray 40#
2' x 60' 35 tray 560#

HEAT EXCHANGERS

6—Adm. 785, 742, 425 sq. ft.
3—St. 2000, 785 sq. ft.
30—Atmospheric Bentube exch., stls and Adm. 715, 470 sq. ft.
30—304 SS shell & tube condensers 100-1000 sq. ft.

MISCELLANEOUS

Lab Petro-chem furnace 50,000 BTU/hr.
Gould 4" Pump 400 gpm 1600' hd.
B-J hot oil pump 3 x 9, 13 st., 325 gpm, 4620' hd.
Gould 16" pump 10,500 gpm, 135' hd.
Tremendous selection stainless steel and steel valves ½" - 6"

Partial List Only

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For Detailed Circular

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FOR SALE: Walker-Neer C-37 Cable Tool Rig fully equipped and ready to work to 8500 feet. For further information and complete inventory of tools please call or write Big State Tool Company, P. O. Box 2024, Phone 7-3052, Odessa, Texas.

Facility for Finishing API Standard External Upset Tubing

We offer for sale a complete facility for finishing oil country drill pipe and tubing to API specification. Present set-up is for 2⅜" and 2⅞" O.D. API Standard External Upset Tubing. Range can be adjusted, with additional dies, to accommodate 1" O.D. to 5" O.D. tubing. Large inventory of die blanks. Facility can be inspected at our plant, Versailles, Pa. Write for descriptive prospectus or telephone: **Mr. W. J. Cornelius**

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2 Lamson Carton Palletizers

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3—800# 20 MMCF Absorbers with Scrubbers, etc.

1—Fluor "Counterflo" Induced Draft Cooling Tower Complete.

Other equipment, Instruments, Pumps, Pipe, Valves and Fittings necessary in Gasoline Plant Construction. Detailed Inventory Available upon request.

Southern Production Company, Inc.

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New Prime Electric Weld, Double Random Length, Plain End, Beveled for Welding.
4,000' 6⅝" O.D. 18.98# per ft.
2,000' 10¾" O.D. 22.88# per ft.
All sizes New Merchant Pipe, Black and Galvanized, ⅛" thru 4". Available for Immediate shipment.

RECONDITIONED WELL CASING
5,000' 4½" O.D. x 10#
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T & C 16-21' Random Length

RECONDITIONED STANDARD PIPE
66,000' 8⅝" O.D. x 28#
20,000' 12¾" O.D. x 50#
20' Random Lengths, Machine Cleaned, Straight, Beveled for Welding.

RECONDITIONED TUBES
10,000' 2" O.D.
10,000' 2½" O.D.
3,000' 3½" O.D.
10,000' 4" O.D.
5,500' 5⅝" O.D.
5,500' 5½" O.D.
Excellent for lines or irrigation purposes.

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Sonken-Galamba Corporation

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4500' 4½" STANDARD LINE. All good threads and couplings, good body. Price 70c. M. J. Regan Pipe Co., Coffeyville, Kans.

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GARDNER-DENVER two-stage gas compressor unitized unit powered by 250 H.P. Buda motor and all equipment, gauges and coolers necessary to operate. All in first-class condition. Gulf Southwest Service Co., P. O. Box 1328, Shreveport, La. Telephone 2-8428.

3500' ROTARY Wilson Super draw works, 145 H.P. Waukesha engine, 87' Pole mast stands, double 7¼x10 mud pump powered with Waukesha, 3000' of 3½" drill pipe complete every way. New in 1954. Sacrifice $33,000.00. Call Hughes, RIverside 2-8147 Nights.

FOR SALE—Bucyrus-Erie 28L Spudder, Waukesha engine. Complete outfit, excellent condition. Call or write W. J. Sloan, 1620 Lake Street, Elmira, New York, Phone 4-9163.

HELP WANTED

INDEPENDENT OIL COMPANY wants Geologist with minimum of three years experience, North and West Central Texas. Should be familiar with all phases of petroleum geology and land work. Submit complete resume and photograph, indicating education, experience and salary requirements. Our employees are aware of this ad. Box J-291, The Oil and Gas Journal, Tulsa, Oklahoma.

PETROLEUM ENGINEER

A large Engineering and Construction Co. now building a very large Oil Refinery on the East Coast desires an Engineering Graduate with at least 5 years' oil refinery supervisory operating experience. This engineer is to assist construction crews in coordination of job completion.

Submit resume and salary requirements to

BOX J-302,
THE OIL AND GAS JOURNAL,
TULSA, OKLAHOMA.

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Experienced graduate engineers for immediate openings in Saudi Arabia and New York City. For engineering work in development, production, drilling, process, and oil and gas engineering on primary and secondary recovery problems.

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For responsible staff position in Saudi Arabia, directing the work of experienced engineers making Petroleum Reservoir Studies. Advise management on Petroleum Reservoir Engineering problems.

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Major Oil Company has openings in drilling, production & pipe line departments in Venezuela for graduate petroleum, mechanical & civil engineers. Salary commensurate with experience. Please send details of experience to:

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Qualified Petroleum Engineers

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Positions open in Arabia. Require petroleum engineering degree from recognized school and suitable experience. One year contract. Excellent benefits. Salary commensurate with experience. Apply in writing, furnishing full description of qualifications and experience to:

AMERICAN INDEPENDENT OIL CO.
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All replies will be held confidential.

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Opening January 15 with active independent for geologist with 2 to 3 years experience in Oklahoma. Reply should include full details of qualifications, education, and past employment.

Box J-272,
THE OIL AND GAS JOURNAL,
TULSA, OKLAHOMA.

HELP WANTED

Plant Equipment Inspectors

Graduate engineers with minimum 5 years' experience in design or inspection of petroleum processing plants and equipment. Major part of experience must have been in inspection work entailing general knowledge of all facilities. Develop inspection methods, supervise and conduct inspections and advise operations on codes and equipment limitations in a major oil installation located in Saudi Arabia.

Write giving full particulars regarding personal history and work experience. Please include your telephone number.

Recruiting Supervisor, Box 90

ARABIAN AMERICAN OIL COMPANY
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PETROLEUM ENGINEER

Major Midwest Bank

has opening for man experienced in valuation of oil and gas reserves. In reply please give resume of experience and salary expected. All replies held confidential.

Box J-275,
The Oil and Gas Journal,
Tulsa, Oklahoma.

DIVISION GEOLOGIST

Aggressive independent oil company has opening in its Tulsa Office for top sub-surface geologist under 40 who has had past experience in Oklahoma. Do not apply unless you are qualified and have major oil company training. Excellent position for right party. In replying, give past employment record, educational background, etc. All replies handled strictly confidential. Reply

Box J-306, The Oil and Gas Journal, Tulsa, Oklahoma.

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Several graduate engineers with minimum 5 years' experience supervising maintenance engineering functions in oil refining or producing facilities, power plants, heavy industrial installations, manufacturing plants or related operations. To establish technical supervision, procedures, maintenance operations and schedule routine and special work for major oil producing and refining operation with all supporting facilities; i.e., housing, feeding, recreation, etc.

Salary commensurate with background and experience. Write giving full particulars regarding personal history and work experience. Please include telephone number.

Recruiting Supervisor, Box 64

ARABIAN AMERICAN OIL COMPANY
505 PARK AVENUE
NEW YORK 22, NEW YORK

HELP WANTED

GAS CONTRACTS MAN—Large mid-continent integrated oil company needs gas sales and contract man with at least 5 years experience in marketing natural gas. Must be experienced in negotiating gas sales contracts and be familiar with potential gas markets in mid-continent and Gulf coast areas. Location, Tulsa, Oklahoma. Our employees know of this ad. Submit experience, qualifications, education, age, and minimum salary requirements to Box J-305, The Oil and Gas Journal, Tulsa, Oklahoma.

PETROLEUM ENGINEERS

Active independent oil company has vacancies for graduate petroleum engineers with two to five years of practical experience in drilling and production in West, West Central or North Texas. Excellent opportunities for growth and advancement. Replies should furnish complete personal data, education, experience, and starting salary desired.

BOX J-300,
THE OIL AND GAS JOURNAL,
TULSA, OKLAHOMA.

SITUATIONS WANTED

LANDMAN—Employed, 4 years Major; Rockies; Titles, Leasing, Joint Ventures, Units, Personnel. Veteran with B.A. and L.L.B. Seeking challenge with independent or small company. Box J-293, The Oil and Gas Journal, Tulsa, Oklahoma.

CATALYST SALES or Technical Representative. 12 years responsible chemical research and catalyst production experience including major company and catalyst manufacturer. Box J-309, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOPHYSICIST: Ten years seismic operational, interpretive, supervisory experience with major; desires position with permanent location. Box J-298, The Oil and Gas Journal, Tulsa, Oklahoma.

PETROLEUM ENGINEER, Age 31, with 5 years Mid-continent experience, desires position with newly organized or established independent oil company. Box J-303, The Oil and Gas Journal, Tulsa, Oklahoma.

PRODUCTION GEOLOGIST. Fifteen years' experience in various phases of oil business in the United States, Canada, South America. Currently senior geologist with major company in South America. Desires connection with future, with organization having active development program. Foreign or domestic. Geologist or Petroleum Engineer. Box J-304, The Oil and Gas Journal, Tulsa, Oklahoma.

ENGINEER ACCOUNTANT
BSPE, BBA

10 years experience in all phases production, drilling and of office work. Desire challenging position with small progressive independent.

BOX J-311,
THE OIL AND GAS JOURNAL,
TULSA, OKLAHOMA.

FOREIGN REPRESENTATIVE

American attorney with considerable experience in Latin America as attorney and/or representative of major oil and mining companies would be interested in making connection with oil company as its foreign representative abroad. Highest references. Fully acquainted with oil concessions, and their negotiation and problems connected with their development.

Box J-307,
The Oil and Gas Journal,
Tulsa, Oklahoma.

ROYALTIES

WANTED: Producing Royalties by Principal. Submit, Engineer's report—Run tickets and Price. R. M. Sims, P. O. Box 447—Phone 1024, Crockett, Texas.

ROYALTIES

OFFERING CHOICE PRODUCING oil and gas income royalties with large reserves per Dollar investments. A. S. Berry, P. O. Box 1383, Tulsa, Okla.

GENIE PETROLEUM, INC.

GRAND JUNCTION, COLORADO

CORPORATION WELL #1

Offering 48 1/64ths Working Interests.

These 1/64th Working Interests are in CORPORATION WELL #1 to be drilled in Garfield County, Utah.

Write for Offering Circular.

GENIE PETROLEUM, INC.,

460E WHITE AVENUE,

GRAND JUNCTION, COLORADO.

PRODUCTION

200 BARRELS DAILY. Have approximately 200 barrels settled production Creek, Payne, Lincoln County, Oklahoma for sale immediately. Have net interest 20 wells under total 35. Income approx. $15,000.00 monthly gross. References please. Box J-301, The Oil and Gas Journal, Tulsa, Oklahoma.

LEASE AND DRILLING BLOCKS

CONTACT A. L. Bowles, Box 947, Ada, Okla., for Drilling Deals, Oil Production.

OWN 460 ACRES in South eastern Kansas. Want someone to drill. E. A. Tanquary, P. O. Box 97, Stanley, Kansas. Phone Olathe 2146W4.

WE OFFER FOR SALE or operating contract two groups of mining properties located in Arizona in excellent winter operating area. On one 600 acre block we are stockpiling copper-gold-silver ore from extensive deposit for delivery to smelter, and doing exploration work on vast titanium deposit of almost limitless quantity. All open pit mining. On another 800 acre block 20 miles away, development work is underway on high quality deposits of rare earth minerals including uranium, cerium, bismuth, columbium, tantalum, neodymium and abrasive feldspar, as well as Serricite and flake mica deposits. Long range economic potential so great it dwarfs normal calculations. Do not reply if not able to spend $100,000.00 or more on first year's operations. For further details address owners at P. O. Box 1235, Amarillo, Texas.

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Producing and Nonproducing
Bought and Sold—Any Area

Inquiries Invited

B. D. BUCKLEY

6635 Delmar Ave., St. Louis, Mo.

FARMS AND RANCHES

VIRGINIA ESTATE

Looking for a farm near Washington, with redecorated 12-room home and every convenience? Orange County Hunt has met on my place for years, and there are foxes galore. Only fifty miles from Washington on side road in Bull Run Mountains near Middleburg. 340 acres, in whole or part, with or without house. Sale by owner.

Box J-299, The Oil and Gas Journal, Tulsa, Oklahoma.

SERVICES

ASPHALT CONSULTANT

Professional service in asphalt refinery operations; paving and roofing asphalts; project research. Emulsions, specialties. Soils. Problems in applied rheology. Plastics.

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HIGHWAY ENGINEERING

EDWIN J. BARTH

54 West Street, Northampton, Mass.

BUSINESS SERVICE

Delaware Corporations formed and serviced. American Guaranty & Trust Company. P. O. Box 487, Wilmington, Delaware.

WANTED

OIL PROPERTIES WANTED. "Oil properties wanted, settled or semi-settled production of 100 to 2,500 barrels daily in Oklahoma and Kansas. Property must stand thorough inspection. Contact Morris Sitrin 1215 First National Building, Tulsa, Oklahoma with particulars.

BUSINESS OPPORTUNITIES

FINANCIAL PARTNERS WANTED: Engineers experienced in design, operation, and Management of Natural Gasoline Plants desire to contact Financial Partners wanting to make a high rate of return with little risk. Box J-306, The Oil and Gas Journal, Tulsa, Oklahoma.

Am interested in leases or blocks for drilling purposes if information will justify. Depth preferred from 1000 to 4000 ft. Also good royalty.

Write or Call

R. E. (BUCK) CLEMENT

Box 65—Ph. 26 or 84

Norman, Oklahoma.

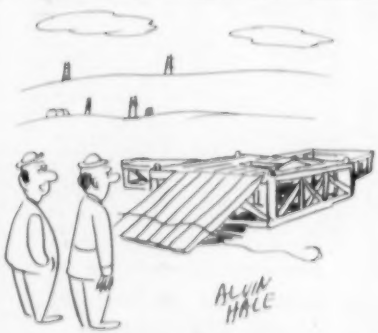
Sand Pump—Oil Field Equipment

For Sale: outright or royalty basis, internationally known sand pumps, release machines, pumping units, machinery, and supplies. Contact

Superior Manufacturing Co.,

G. W. Miller, President, Patentee of Superior Sand Pumps, also patentee, former Miller Sand Pump.

525 So. Oklahoma, Sapulpa, Okla.



"We forgot about such a small thing as payments on the rig and one day we discovered it was gone."

Equipment Men

Finch Supply to Handle Nordstrom Plug Valves

Finch Supply Co., Houston, has been appointed an authorized stocking distributor for Rockwell-Nordstrom lubricated plug valves. Over the past 6 years Finch has established a reputation as specializing in pipe, valves, and fittings.

Other Finch lines include: Crane Co., Tube-Turns, Watson-Stillman Co., Youngstown Sheet & Tube Co., Whitlock Cordage Co., as well as a complete line of seamless steel pressure tubing, swage nipples, bull plugs, pipe nipples, wire rope, leading oil-field specialty products, and industrial supplies.

Texsteam Names Stewart To Sales in Gulf Area

James F. Stewart has joined Texsteam Corp., Houston, as sales representative in the Gulf Coast area. He will handle Texsteam's new separation and dehydration equipment. Stewart was employed by Maloney-Crawford in Corpus Christi for 1½ years and by Lane-Wells for 3½ years.

Texsteam, a division of Vapor Heating Corp., Chicago, manufactures a line of safety valves, injector pumps, boilers, and oil heaters.

Jacobs Engineering to Represent Koch in California

In line with its accelerated expansion program, Koch Engineering Co., Wichita, Kans., has appointed Jacobs Engineering Co., Pasadena, Calif. representative for that area, according to a recent announcement.

Jacobs Engineering, headed by Joe Jacobs, president, has handled items for the oil and chemical industries since 1947 and has a long history of successful representation in the west coast area. Jacobs Engineering also has a branch office at Oakland, Calif., headed by Thomas B. Dorris. The Oakland office provides service for the northern part of the state.

As Koch representatives in California, Jacobs Engineering will sell and handle the installation of Koch Flexitray and Koch Benturi fractionating trays for refineries and chemical plants.

York Appoints Hassman As Sales Manager

Harry F. Hassman has been appointed sales engineer for the affiliated companies, Otto H. York Co., Inc., and New York Process Equipment Corp., West Orange, N. J. He will service the chemical and petroleum industries in connection with liquid-vapor and liquid-liquid separation problems.

Prior to joining York, Hassman was a process engineer with Fluor Corp. in Los Angeles.

Carbro Appoints Nutt As Kansas Representative

Carbro, Inc., Wichita, Kans., makers of the Carbro fuel generator, has appointed Ted L. Nutt as Kansas representative for its product, according to Robert M. Carey, president of the corporation.

Nutt is well known in the oil-field equipment business, having been assistant manager of the Mid-Continent area for Parkersburg Rig & Reel Co.

Continental to Operate As A Division of Youngstown

J. L. Mauthe, president of Youngstown Sheet & Tube Co., announced today that effective January 1, 1956, the oil-field supply business conducted by its wholly owned subsidiary, Continental Supply Co., will be operated as a division of the parent company, rather than as a separate subsidiary. This phase of Youngstown's operations will now be conducted under the name Continental Supply Co., a division of Youngstown Sheet & Tube Co.

Mauthe stated that this change is being made to simplify the company's corporate structure and that no change in personnel or in sales or operating policies is contemplated.

Rector Occupies New Odessa Warehouse

This Odessa, Tex., warehouse of Rector Well Equipment Co., Inc. is another factor in the company's policy of faster shipment of wellhead and cementing equipment. The new warehouse is open 6 days a week with 24-hour-a-day telephone service. W. P. Knight, West Texas division manager, is in charge; J. G. (Red) Wingfield is warehouseman. Field representatives working out of the Odessa warehouse are Grady L. Cooper, Paul Kittrell, and Leon Splawn.

ADVERTISERS

Allis-Chalmers Mfg. Co. 39
Allison Division of General Motors 154
American Cable Division of American Chain & Cable 11
Baird Mfg. Co. 132
Baker Oil Tools, Inc. 54
Beaird Company, Inc., The J. B. 37
Beech Aircraft Corporation 75
Bethlehem Steel Co. 133
Black, Sivalls & Bryson, Inc. 14
Bos-co Equip't Eng'r'g & Mfg. 132
CF&I Tubular Products, The Colorado Fuel and Iron Corporation 23
Chicago Bridge & Iron Company 73
Classified Advertising 169, 170, 171, 172
Coates Field Service, Inc. 127
Continental Supply Co., The 20, 21
Core Laboratories, Inc. 146
Council of British Manufacturers of Petroleum Equipment 123
Crose Manufacturing Co., Inc., M. J. 126
Dean Hill Pump Company 12
Delta Tank Manufacturing Co., Inc. 43
Dowell Incorporated 118, 174
Drilling & Service, Inc. 157
Drive-Thru Gate Co. 153
Emsco Manufacturing Company 20, 21
Enardo Manufacturing Company 158
Fairbanks, Morse & Co. 4
First National Bank & Trust Co. of Tulsa, The 44
Fisher Research Lab., Inc. 127
Fluor Products Company, A Division of The Fluor Corporation, Ltd., The Inside Front Cover
Foxboro Company, The 33
Franks Division, Cabot Shops, Inc. Inside Back Cover
Gates Rubber Co., The 50
General American Transportation Corporation 52
General Electric Co., Electronic Dept. 36
Globe Oil Tool Company 130
Goodrich Company, B. F. 5
Grancell, I. H. 131
Graver Tank & Mfg. Co., Inc. 22
Guiberson Corporation 134
Halliburton Oil Well Cementing Co. 15, 56
Holmar Corporation 156
Houston Oil Field Material Company, Inc. 109
Huey & Co., S. E. 127
Hughes Tool Co. Back Cover
Inferno Co., The 131, 156
International Harvester Co. 16, 17, 35
Jones & Laughlin Steel Corporation Supply Division 10
Kellogg Co., The M. W. 24, 25
Layne & Bowler, Inc. 46
Link-Belt Company 7
Maloney-Crawford Tank & Mfg. Co. 28
Manton-Gaulin Manufacturing Company, Inc. 42
Moorlane Company 128
Murphy Manufacturer, Frank W. 153
National Bank of Commerce, The 41
Oil Well Supply Division 6
Olin Mathieson Chemical Corporation, Industrial Chemicals Division 8
Oliver Corporation, The 9
Orbit Valve Company 76
Pacific Lumber Company, The 30
Paris Distributor, Inc., Henry H. 49
Parkersburg Rig & Reel Co. 18
Peerless Supply Co. Inc. 127
Petroleum Distributing Co. 45
Republic Steel Corporation 124, 125
Rockford Clutch Division of Borg-Warner 34
Roebling's Sons Company, John A. 38
Ryerson & Son, Inc., Joseph T. 138
Scott-Rice Company 156
Spang & Co. 150
Stewart & Stevenson Services, Inc. 29
Sucker Rod Pumping Research, Inc. 153
Tennessee Corporation 51
Thomas Flexible Coupling Co. 129
Timken Roller Bearing Company 19
Tuboscope Company 13
Union Tank and Supply Company 132
United States Steel Corporation—Oil Well Supply Division 6
United States Treasury Dept. 26
United Supply & Manufacturing Co. 48
Visco Products Co., Inc. 103
Vulcan Steel Tank Corp. 156
Walker-Neer Manufacturing Company 152
Warren Petroleum Corporation 56
Waukesha Sales & Service, Inc. 32
Weil Equipment Mfg. Corp. 151
Western Supply Company 106, 107
Wheland Company, The 27
Willson Products, Inc. 47
Willys Motors, Inc. 40

Successful Wildcats

(Continued from page 159)

SASKATCHEWAN

Sohio 1-27 Halbrite, LSD 1, 27-6-12w2. TD 4,683 ft. Oilwell.

McCarty & Coleman 6-26 Knight, LSD 6, 26-7-34w1. TD 3,986 ft. Oilwell.

Amurex-Canso Natural Gas 2-7 Tunstall, LSD 7, 9-14-28w3. 1,719 ft. Gaswell.

TEXAS PANHANDLE

Ochiltree County: Machris 14-147 Harbaugh, C SW SW Block 13, Sec. 147, T&NO Sur. IPF 91 M.c.f. of gas per day and 5 bbl. distillate per million, Morrow sand 8,464-83 ft., 59.4°. TD 8,982 ft. (Gas-distillate discovery.)

UTAH

Grand County: Three States Natural Gas Co., Coulston Drilling Co., W. R. Gibson, Jr. 1 Cullen-Government, NE NE NE 15-20s-23e. IP 350 M.c.f. of gas per day, Morrison discovery, new field. TD 2,589 ft. Entrada.

Uintah County: Carter 1 Richtmann-Federal, NE SW SE 5-7s-23e (USM). IPF 1,400 M.c.f. of gas per day, Uinta discovery, new pay. TD 6,004 ft. Wasatch.

WYOMING

Sublette County: El Paso-Continental-Malco 2 Unit, C SW SE 29-31n-108w. IP Shut in gas well. TD 10,685 ft. Fort Union gas discovery, new field.

El Paso 3 Unit, C NW 13-31n-109w. Shut in gas well. TD 11,009 ft. Fort Union gas discovery, new field.

LEGAL

U.S. DEPARTMENT OF THE INTERIOR, Bureau of Land Management, Land Office, Salt Lake City, Utah, December 29, 1955. Notice is hereby given that approximately 228 acres of land in lots 1, 2, E½ NW¼ Sec. 17; lots 1, 2, 3, 4 Sec. 18, T. 14 S., R. 7 E., S.L.M., Utah, within the known geologic structure of Clear Creek Field, undefined, in Carbon and Emery Counties, Utah, will be offered in one parcel for oil and gas leasing through competitive bidding to the qualified bidder of the highest cash amount per acre at 2:00 p.m., M.S.T., January 23, 1956, when bids will be opened. Details of the lease offering, how and where to submit bids may be obtained from the Bureau's Land Office, Post Office Box 777, Salt Lake City 10, Utah. E. E. House, Manager.

LEGAL

Sealed bids will be received until 2:00 P. M. Monday, January 16, 1956, and opened at that time at the Pawnee Area Field Office, Pawnee, Oklahoma for the leasing of allotted lands located in Kay, Noble, Pawnee and Payne Counties, Oklahoma, for oil and gas mining purposes. For additional information write or telephone Mr. John L. Johnson, Area Field Representative of the Pawnee Area Field Office (phone 985).

LEGAL

SEALED BIDS will be received until 2:00 P.M., Mountain Standard Time, January 24, 1956 and opened at that time in the Office of the Uintah and Ouray Indian Agency, Fort Duchesne, Utah, for the leasing of 64,276.07 acres of Tribal land and 1,198.52 acres of Reserved land in 27 separate parcels, located in Townships 1 and 2 North, Ranges 1 East and 1, 2, 3 and 4 West, Uintah Special Base and Meridian Survey, Uintah and Duchesne Counties, Utah, for oil and gas mining purposes. The details of the lease offering and how and where to file bids may be obtained by addressing the inquiry to Mr. John O. Crow, Superintendent of the Uintah and Ouray Agency, Fort Duchesne, Utah or to the office of the Regional Oil and Gas Supervisor, U. S. Geological Survey, Casper, Wyoming.

Dowell's paddle mixing equipment supplies a constant flow of properly mixed materials to the large-volume pumps.

FRACTURE AND ACIDIZE IN ONE ECONOMICAL TREATMENT!

ACID PETROFRAC* is an exclusive Dowell fracturing treatment with double action for better results with less rig time. It uses an acid-in-oil emulsion to fracture and acidize in one operation. Acid constitutes 90 to 95% by volume of the total mixture. The oil phase may be kerosene, diesel oil or crude oil.

Its high acid content with retarded acid properties means deeper penetration, extended drainage pattern and increased permeability. Sand carrying ability is high, up to 6 pounds per gallon—even at high temperatures.

Dowell engineers tailor each Acid Petrofrac treatment to fit your well requirements. Fluids can be premixed or prepared at the well site in Dowell's paddle mixing equipment. The mixture can be regulated to obtain the proper viscosities and fluid loss. Properties which prevent the swelling of silicates in the spent acid solution are inherent in Acid Petrofrac. No gel-breaker is needed. No shut-in time is required.

For more information or service, call any of the 165 Dowell offices in the United States and Canada; in Venezuela, contact United Oilwell Service. Or write to Dowell Incorporated, Tulsa 1, Oklahoma, Department A-11.

*Service Mark of Dowell Incorporated

services for the oil industry

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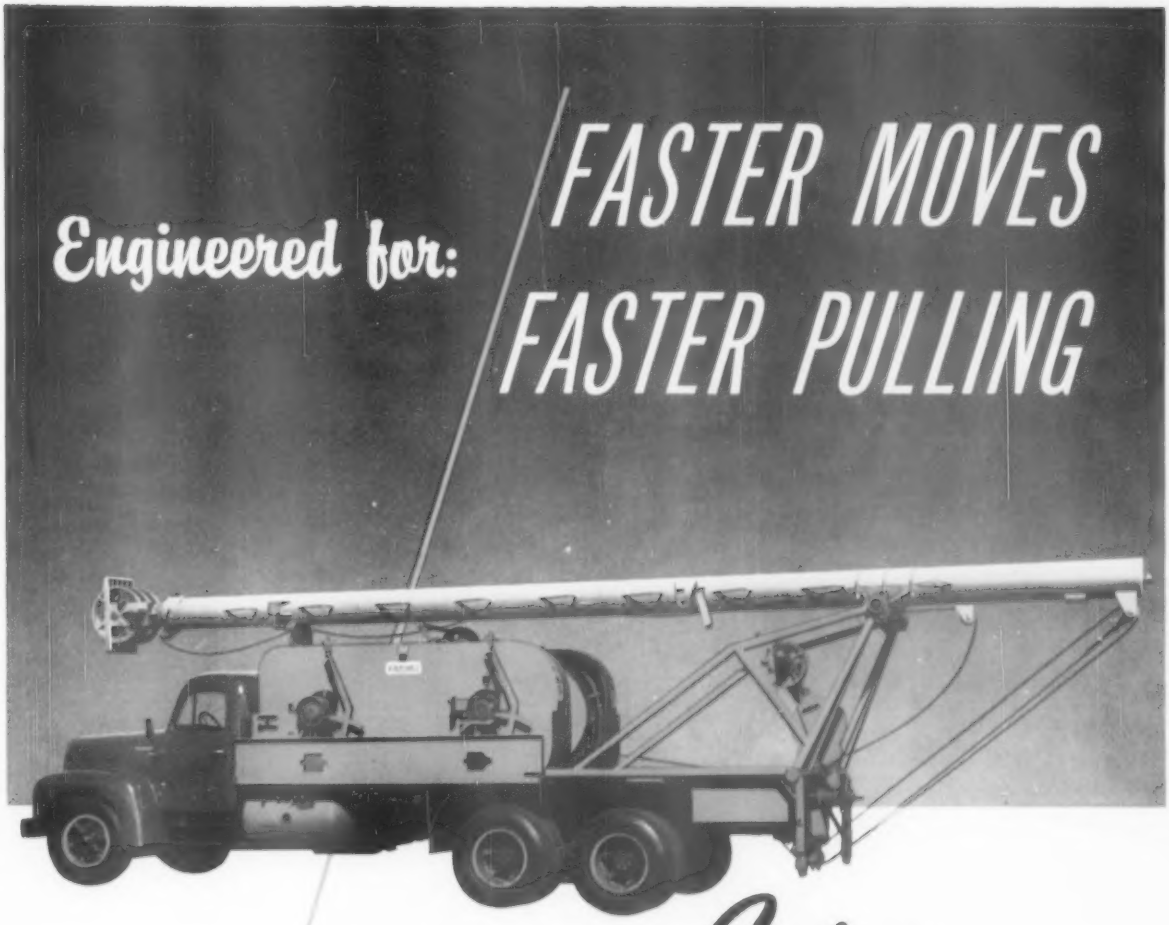
Engineered for: FASTER MOVES FASTER PULLING



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Franks Cruiser, the most widely accepted pole mast well servicing unit, has set the standard of performance and economy for rod and tubing jobs.

Franks Cruiser is especially economical in areas where there is considerable waiting time on such operations as swabbing.

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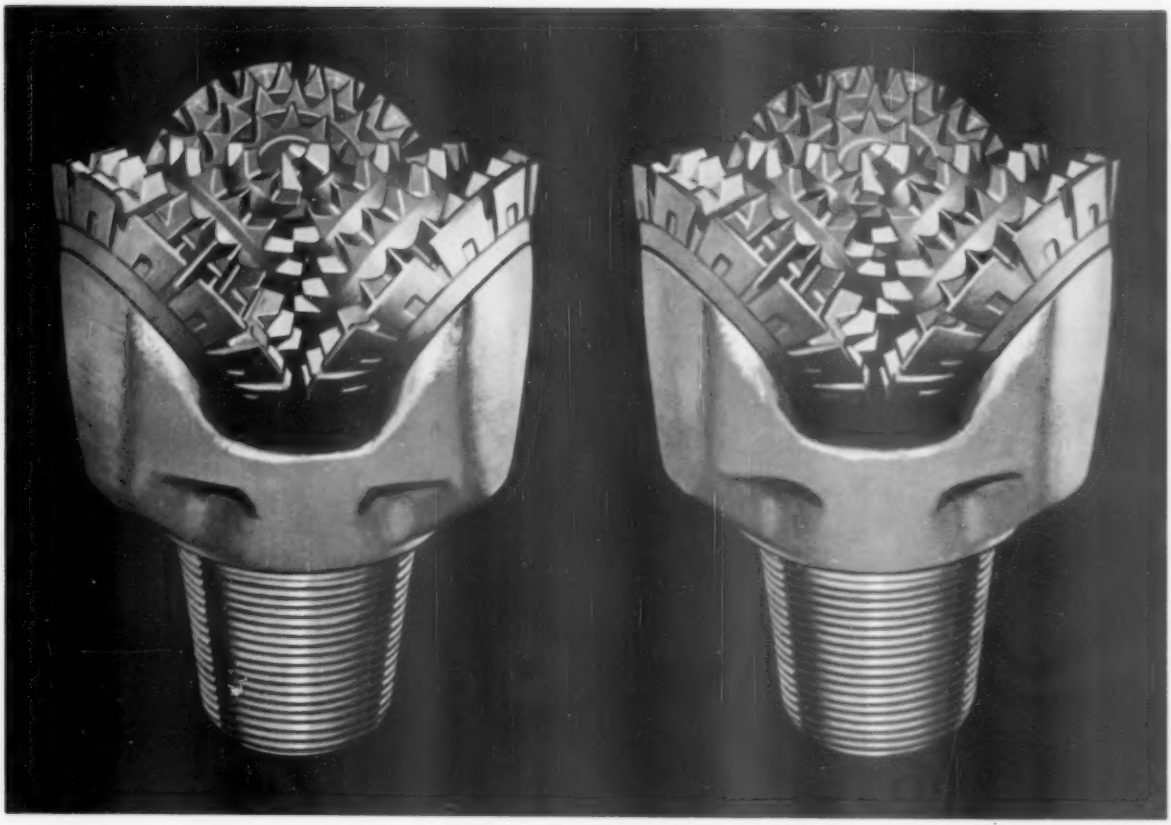

THEY LOOK ALIKE ... but

Because bits look alike is no certainty they will perform alike. Take the case of the two bits shown here.

There is a metallurgical improvement in the second bit that was not present in the first. This combined with design changes gives the bit greater stamina and assures *more hours on bottom . . . making more hole!*

This is another example of the constant changes being made by HUGHES to enable operators to take full advantage of new drilling techniques.